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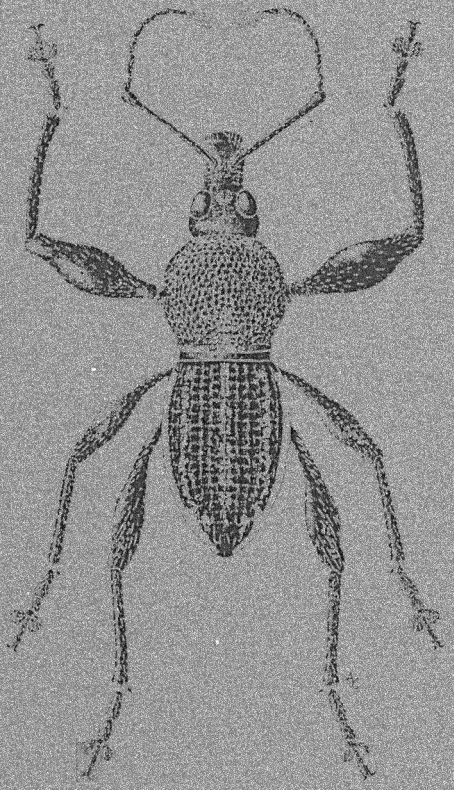

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Cover: *Oribius destructor* is one of about 50 species of small, flightless beetles within the genus *Oribius*. Most are restricted to the highlands of New Guinea. *Oribius destructor* Marshall is a major pest of horticulture in Papua New Guinea and is particularly damaging to citrus, apples, capsicums, strawberries and avocardos. Damage is caused by the feeding of the adults, causing leaf shot-holing, stem and fruit scarring, and branch dieback. Illustration by Amy Carmichael.

ORSOTRIAENA MEDUS LICIUM (FRUHSTORFER) (LEPIDOPTERA: NYMPHALIDAE: SATYRINAE) IN QUEENSLAND, AUSTRALIA

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Abstract

The underside ocelli patterns and the width and prominence of the underside white transverse lines on 39 specimens of *Orsotriaena medus licium* (Fruhstorfer) from Papua New Guinea and 91 *O. m. moira* Waterhouse & Lyell from Torres Strait were examined and their variability assessed. Based on these assessments, *O. m. moira* is placed as a new synonym of *O. m. licium*, with the latter becoming the appropriate subspecific name for *O. medus* (Fabricius) in Australia. In addition, specimens of *O. m. licium* from Torres Strait, collected throughout the wet season, showed a higher frequency of extra ocelli on the underside of the wings of both sexes than specimens from Papua New Guinea, which were mostly collected during the dry. In contrast, the width and prominence of the underside white transverse lines in both populations did not correlate with season or gender. Two Torres Strait specimens collected in February 1994, during the wet season, are similar to a dry season form recorded from India.

Introduction

Orsotriaena medus (Fabricius) is a tropical Indo-Australian satyrine butterfly occurring from India to southern China and the Philippines, throughout Malaysia, Indonesia and New Guinea, east to the Solomon Islands and Vanuatu and south to Australia through Torres Strait, including the northernmost tip of Cape York Peninsula (Parsons 1998, Braby 2000, Sands and New 2002). Within Australia, *O. m. moira* Waterhouse & Lyell is most frequently encountered on the northern and eastern islands of Torres Strait. It is considered rare in the south of the Strait and was last recorded at Cape York in 1976 (Braby 1995, 2000, Sands and New 2002, TAL unpublished data). It is generally confined to wet grassy areas along the edges of lowland rainforests and swamps (Braby 1995, 2000, Sands and New 2002) and in Torres Strait is predominately a wet season butterfly.

Within Torres Strait, *O. m. moira* is known from Darnley, Dauan, Moa, Murray, Thursday and Yam Is, which hold stands of monsoonal vine forest, and from Saibai, which is a flat mud island (Waterhouse and Lyell 1914, Lambkin and Knight 1990, Valentine and Johnson 1993, Braby 2000, TAL unpublished data). Dunn *et al.* (1994) considered it to be threatened by fire and vegetation clearance, particularly in Torres Strait, but Sands and New (2002) regarded the species as safe in Australia due to its close association with damp grassy environments. In Australia, its life history was described from material collected from Dauan Island by Johnson *et al.* (1995), who successfully reared larvae on the introduced *Panicum maximum* Jacq. (Poaceae: guinea grass) after enclosing females on *Imperata* sp. (Poaceae).

Braby (2000) questioned the validity of *O. m. moira* and considered it to differ little from the Papua New Guinea subspecies; he concluded that its

status was doubtful. Up until the last decade, few specimens were known from Australia, but in recent years more systematic collecting of butterflies in Torres Strait has been done and now more specimens of *O. m. moira* are available for study. An assessment of these additional specimens supports the doubt surrounding the status of *O. m. moira*. In this paper, the external facies of a series of *O. medus* from Torres Strait are examined and their variability documented, in particular the underside ocelli patterns and the white transverse lines. This variability is compared with that of specimens of *O. m. licium* (Fruhstorfer) from Papua New Guinea and a form of *O. medus*, perhaps seasonal, is recorded from Australia for the first time.

Abbreviations used are as follows: PNG – Papua New Guinea; AIK – A.I. Knight; EC – E. Cameron; EJLH – E.J.L. Hallstrom; MFB – M.F. Braby; PSV – P.S. Valentine; TAL – T.A. Lambkin; WWB – W.W. Brandt; ANIC – Australian National Insect Collection, Canberra; QDPI – Department of Primary Industries and Fisheries Collection, Brisbane; MFBC – M.F. Braby collection, Palmerston; TLIKC – Joint T.A. Lambkin and A.I. Knight collections, Brisbane; PSVC – P.S. Valentine collection, Townsville; UQIC – University of Queensland Insect Collection, Brisbane.

Material examined

QUEENSLAND (TORRES STRAIT): 18 ♂♂, 10 ♀♀, Dauan Island, 2.iv.2001 (♂, ♀), 4.iv.2001 (3 ♂♂, 2 ♀♀), 22.iv.2001 (♀), 24.iv.2001 (♀), 2.v.2001 (♀), 10.ii.2006 (♀), 14.ii.2006 (♀), 18.ii.2006 (♂), 20.ii.2006 (♀), 23.ii.2006 (♂), 24.ii.2006 (♂), 2.iii.2006 (♂), 8.iii.2006 (2 ♂♂, ♀), 9.i.2008 (♂), 10.i.2008 (2 ♂♂), 12.i.2008 (♂), 13.i.2008 (3 ♂♂), 19.i.2008 (♂), AIK (TLIKC); 9 ♂♂, 5 ♀♀, same data except 19.ii.2004 (6 ♂♂, 2 ♀♀), 20.ii.2004 (♀), 21.ii.2004 (♂, ♀), 22.ii.2004 (♂), 11.i.2006 (♀), 17.i.2008 (♂), TAL (TLIKC); 6 ♂♂, 3 ♀♀, same data except 2.iv.2004 (2 ♂♂), 3.iv.2004 (2 ♂♂, ♀), 6.iv.2004 (♂, ♀), 7.iv.2004 (♂, ♀), PSV (PSVC); 1 ♂, Green Hill, Thursday Island, 12-15.iv.1992, TAL (TLIKC); 1 ♂, Moa Island, 10°11'S, 142°18'E, 24.ii.1975, EC (UQIC); 9 ♂♂, 3 ♀♀, Murray Island, 22-25.iv.1989, TAL (TLIKC); 6 ♂♂, 1 ♀, same data except 29.iii.-4.iv.1986 (QDPI); 2 ♂♂, 3 ♀♀, same data except 24.iv.1989 (2 ♂♂, ♀), 25.iv.1989 (2 ♀♀), AIK (TLIKC); 2 ♂♂, 4 ♀♀, same data except 17.iii.1993 (♀), 14.iv.1993 (♀), 16.iv.1993 (♀), 18.iv.1994 (2 ♂♂, ♀), PSV (PSVC); 1 ♂, 1 ♀, Saibai Island, 5.iv.2001 (♀), 10.ii.2004 (♂), AIK (TLIKC); 4 ♂♂, 1 ♀, same data except 21.ii.1994 (2 ♂♂), 22.ii.1994 (♂, ♀), 1.iii.1996 (♂), TAL (TLIKC); 2 ♂♂, 1 ♀, same data except 11.iv.1994, PSV (PSVC).

PAPUA NEW GUINEA: 3 ♂♂, 1 ♀, Angoram (Sepik District), 20', 30.iii.1950 (♂), 6.iv.1950 (♀), 2.v.1950 (2 ♂♂), WWB & EJLH (ANIC); 1 ♂, 2 ♀♀, Bubia, nr Lae, no other collection data (UQIC); 3 ♂♂, Kiunga, Fly River, 2.vii-31.x.1957, WWB (ANIC); 5 ♂♂, Lae, 10.vi.1951 (2 ♂♂), 21.vi.1951 (♂), 3.vii.1951 (2 ♂♂), WWB & EJLH (ANIC); 1 ♂, Maprik (Sepik District), 600', 30.vi.1951, WWB & EJLH (ANIC); 2 ♂♂, 2 ♀♀, Marabi, Lae, Morobe Province, 12.vi.1999, MFB (MFBC); 1 ♂, Normanby Island, Wakaiuna, Sewa Bay, 23.x.1956-11.i.1957, WWB (ANIC); 5 ♂♂, 3 ♀♀, Rouku, Morehead River, Western District, no collection date (5 ♂♂, 2 ♀♀), 19.iii.-28.v.1962 (♀), WWB (ANIC); 7 ♂♂, 3 ♀♀, Subitana (Central District), Rauna, 1800 ft, 6.x.1949 (6 ♂♂, 3 ♀♀), 16.x.1949 (♂), WWB & EJLH (ANIC).

Methods and results

Orsotriaena medus is a variable species (Braby 2000), predominately in the numbers of ocelli in the subapical, subterminal and subtornal areas of the underside of both wings and in the width, prominence and length of the underside white transverse line. The variability of these two features was investigated in 39 specimens of *O. m. licium* and 91 of *O. m. moira* from PNG and Torres Strait respectively, to determine if differences within these features could be used to support their subspecific separation.

The number and positions of ocelli on specimens from Torres Strait were difficult to qualify, with some variation even within groups of specimens collected from single locations and at single times. Variability in the number of ocelli in some tropical Satyrinae has been reported previously (Owen 1971, Brakefield and Larsen 1984) and is also known for *O. medus*, where it appears to be seasonally influenced, with dry season individuals often having fewer underside ocelli (Bingham 1905, Woodhouse 1950, Wynter-Blyth 1957, Brakefield and Larsen 1984, Parsons 1998). This seemed to hold true for the material used in the present study. All Torres Strait specimens were collected over the wet season between January and May and contained a proportion of specimens (16/91, about 18%) with additional smaller ocelli (Fig. 1), whereas most had the more common ocelli pattern (Fig. 2). In contrast, almost all PNG specimens examined possessed the latter ocelli pattern (Fig. 3), with only two individuals having some extra small ocelli (Fig. 4). Almost all PNG specimens (when collection dates were known) were collected during the latter half of the year, when the season is typically dry (Parsons 1991). Because of this seasonal influence, the use of ocelli number as a diagnostic feature in comparing the two populations was considered unreliable.

The width and prominence of the underside transverse white lines were also assessed. For each specimen, measurements of the width of the transverse line were made in the subterminal area of the hind wing in the space between veins Rs and M_1, to assess if width and prominence of this line might be a discerning feature between the two populations. This character was also found to be variable. In both populations, individuals with a distinctive broad white line (approximately 1 mm wide), somewhat similar in appearance to that of *O. m. medus*, were the only specimens that could be reliably tagged and compared (although the white line in *O. m. medus* is also known to vary) (Fleming 1975, Corbet and Pendlebury 1978, D'Abrera 1983). About equal proportions of this form occurred in both populations, *i.e.* 8/39 (21%) in *O. m. licium* (Fig. 5) and 21/91 (23%) in *O. m. moira* (Fig. 1) The white transverse markings on the remaining specimens of both populations were highly variable and ranged from long, thin white prominent lines not wider than 0.5 mm (Figs 4, 6) to very faint, almost indistinguishable lines that were highly variable in length (Figs 2, 3, 7).

There was no correlation between the frequency of the morph with a broad white line and the gender of individual specimens, as this form was represented in both populations by similar male : female ratios (1 : 1 in *O. m. licium* and 1 : 1.3 in *O. m. moira*). This character did not seem linked to season as specimens from both populations showed the same overall degree of variability, despite being collected in different seasons. Moreover, a complete range of band widths was found in a series of 12 specimens, including both sexes, collected on Dauan Island in February and March 2006.

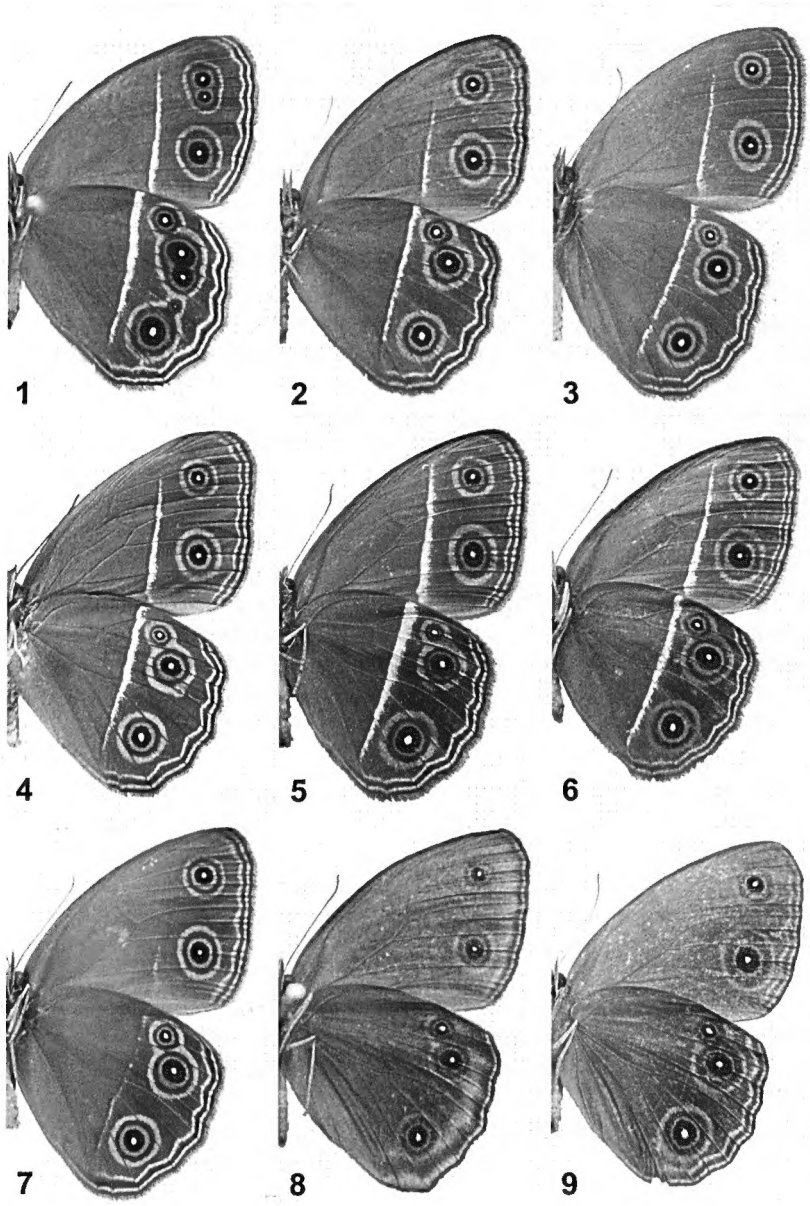
Two Torres Strait specimens collected on Saibai Island in February 1994 lacked all trace of the transverse lines (Figs 8, 9) and one of these was also devoid of the typical subterminal white slender lines on the underside of both wings (Fig. 8). Similar forms of *O. medus* have been reported from India during dry seasons (Bingham 1905, Woodhouse 1950, Wynter-Blyth 1957), wherein the white transverse markings are very much reduced or absent (Brakefield and Larsen 1984).

Discussion

The type locality of *O. medus* remains uncertain. Fabricius (1775) had erroneously indicated 'Capite Bonae Spei' [Cape of Good Hope, South Africa]. Waterhouse and Lyell (1914), Vane-Wright and de Jong (2003) and Tennent (2006) considered the type to have come from southern India but Edwards *et al.* (2001) followed Zimsen (1964) in regarding the type locality as Java, Indonesia. Nonetheless, across the species' range the markings on the underside of both wings are highly variable, in particular the number of ocelli and the width, length and prominence of the white transverse band or line. This variability has led to descriptions of a number of 'races' seemingly based primarily on the thickness of this underside white transverse line. Size and number of ocelli are highly variable in all races (Bingham 1905, Woodhouse 1950, Brakefield and Larsen 1984, Parsons 1998).

A number of subspecies have recently been synonymised with *O. m. medus* (Aoki *et al.* 1982, Vane-Wright and de Jong 2003) but Tennent (2006) still considered *O. m. licium* to be valid, although he noted that the regional biogeography of this species required revision.

Figs 1-9. *Orsotriaena medus licium* (Fruhstorfer). All figures are undersides and not to scale. (1) female, Dauan I., Torres Strait, 2.v.2001, AIK (TLIKC) [forewing length = 26 mm]; (2) male, Murray I., Torres Strait, 24.iv.1989, AIK (TLIKC) [23 mm]; (3) male, Subitana (Central District), Rauna, 1800 ft, PNG, 6.x.1949, WWB & EJLH (ANIC) [22 mm]; (4) male, Rouku, Morehead Riv., Western District, PNG (ANIC) [25 mm]; (5) male, Dauan Island, 2.iii.2006, AIK (TLIKC) [24 mm]; (6) male, Dauan I., 4.iv.2001, AIK (TLIKC) [23 mm]; (7) male, Kiunga, Fly Riv., PNG, 2.vii.-31.x., WWB (ANIC) [26 mm]; (8) male, Saibai I., Torres Strait, 21.ii.1994, TAL (TLIKC) [21 mm]; (9) male, Saibai I., 22.ii.1994, TAL (TLIKC) [23 mm].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Overall, the currently accepted subspecies appear to be: *O. m. medus* ranging from northern India east to Malaysia and western Indonesia (Bingham 1905, Corbet and Pendlebury 1978, D'Abrera 1983); *O. m. mandata* Moore from southern India and Sri Lanka (Bingham 1905, Woodhouse 1950, Wynter-Blyth 1957); *O. m. licium* from Sulawesi to Papua New Guinea (Fruhstorfer 1908, D'Abrera 1978, Parsons 1998); *O. m. mutata* (Butler) from the Solomon Archipelago and Vanuatu (Tennent 2002, 2006); and *O. m. moira* from Torres Strait and Cape York, Australia (Waterhouse and Lyell 1914, Braby 2000).

The most boldly marked of these subspecies are *O. m. mandata* and *O. m. mutata*, where the white transverse band is very prominent and broad, so much so that on some specimens it touches the edges of the ocelli (Woodhouse 1950, Wynter-Blyth 1957, Tennent 2002). The other races are highly variable but, as a rule, the transverse band on *O. m. medus* appears to be consistently broader and better defined than the band on *O. m. licium* and *O. m. moira* (Fleming 1975, Corbet and Pendlebury 1978, D'Abrera 1978, 1983).

Closer to Australia, Parsons (1998) reported *O. m. licium* as occurring widely throughout the PNG mainland and its offshore islands of New Britain, New Ireland, Bougainville and Daru. The occurrence of *O. m. licium* on Daru is of particular interest as it lies just off the southern coast of the Western Province of PNG, very close to Torres Strait and just 50 km northeast of Saibai Island, where *O. m. moira* is known to occur.

The description of *O. m. moira* by Waterhouse and Lyell (1914) was based on 22 males and 10 females from Cape York, Banks (Moa) and Darnley Islands. Waterhouse and Lyell (1914) failed to designate a holotype but Peters (1971) considered it likely that Cape York was the type locality and designated a lectotype (Edwards *et al.* 2001). Within their description, Waterhouse and Lyell (1914) made no mention of any feature that distinguished *O. m. moira* from *O. m. licium* from PNG, only mentioning that, on the underside, *O. m. moira* had 'a well defined white discal line', oddly a feature atypical of the specimens examined in this current study from Torres Strait and PNG. Furthermore, they indicated that the white line was 'variable in width and intensity', somewhat contradictory to their main character ('a well defined white discal line') on which they appear to have based their description. In addition, they offered no explanation to validate the grounds they used to erect their subspecies as their description was not unlike that of Fruhstorfer's (1908), who indicated that specimens from Celebes [Sulawesi] to New Guinea had a thin white transverse line on the underside. Based on my examination of Torres Strait and PNG specimens in this study, Fruhstorfer's (1908) description of *O. m. licium* matches the majority of specimens reviewed here. It is unknown whether Waterhouse and Lyell (1914) examined any New Guinea material at the time they described

O. m. moira, but if they had they surely would have noticed the similarity between *O. m. licium* and their Torres Strait material. What is possible is that they were unaware of *O. m. licium* at the time they described *O. m. moira*, as Fruhstorfer's (1908) description was published only six years earlier than theirs (Waterhouse and Lyell 1914).

The two Saibai Island specimens lacking any trace of an underside white transverse line were collected in February, which is typically wet in Torres Strait. This is opposite to that reported by Brakefield and Larsen (1984), who illustrated a form from Sikkim (in northern India) that was very similar to the two Torres Strait specimens but specified that it was strictly a dry season form. They also indicated that this form occurs in Bangladesh and in parts of Thailand and Burma. If the two Australian specimens reported here are seasonal in effect, then this is the first report of this dry season form from Australia.

In summary, the results of this current study indicate that the underside variability of *O. m. moira* from Torres Strait is similar to that of *O. m. licium* from Papua New Guinea. Ocelli number might be a seasonal character in both populations and the prominence of the underside white transverse line does not appear to be influenced by season or gender. Based on the evidence provided here, *O. m. moira* Waterhouse & Lyell is placed as a new synonym of *O. m. licium* (Fruhstorfer), with the latter name becoming the appropriate subspecific name for *O. medus* populations in Australia.

Acknowledgements

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THOPHA HUTCHINSONI, A NEW CICADA (CICADOIDEA: CICADIDAE) FROM WESTERN AUSTRALIA, WITH NOTES ON THE DISTRIBUTION AND COLOUR POLYMORPHISM OF *THOPHA SESSILIBA* DISTANT

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Abstract

Thopha hutchinsoni sp. n. is described from Western Australia, where it is found near Exmouth and at the eastern fringe of the Pilbara region. New records of *T. sessiliba* Distant are given, confirming the presence of the species west of the Great Sandy Desert. The colour of these 'western' *sessiliba* is different from specimens found east of the Great Sandy Desert and it is suggested that these 'western' *sessiliba* might represent another new species. A population of melanic *T. sessiliba* is recorded from Haliday Bay, near Mackay, Queensland and a melanic individual from near Chillagoe, Queensland, is also noted. A brief discussion on the size of *Thopha* Amyot & Serville species concludes that *T. saccata* (Fabricius) remains Australia's largest cicada.

Introduction

The cicada genus *Thopha* Amyot & Serville includes four described species distributed through New South Wales, Queensland, the Northern Territory and Western Australia (Moulds 2001). All are large to very large species and include *T. saccata* (Fabricius) and *T. emmotti* Moulds, which vie for the title of largest Australian cicada species.

Three of these *Thopha* species, *T. saccata*, *T. sessiliba* Distant and *T. colorata* Distant, were described 100 or more years ago. *T. emmotti* was described as recently as 2001 and its discovery was unexpected. Now, the discovery of yet another species of *Thopha* in Western Australia, which rivals *T. saccata* and *T. emmotti* in size, is even more remarkable; the first specimens were collected only in 2004. This new species, described here as *T. hutchinsoni*, appears most closely related to *T. sessiliba.*

New distribution records for *T. sessiliba* are also provided, including a number of records from west of the Great Sandy Desert, Western Australia. These western *sessiliba* are consistently different in colour pattern and it is suggested that they might represent yet another new species. Melanic colour morphs of *T. sessiliba* are also documented.

Terminology for morphological features follows that of Moulds (2005) except for timbal structure, which follows Bennet-Clark (1999). The following abbreviations have been used for collections housing specimens: AE - collection of A. Ewart; AM - Australian Museum, Sydney; PH - collection of Paul Hutchinson; MSM - collection of M.S. Moulds; WAM - Western Australian Museum, Perth.

Thopha hutchinsoni sp. n.

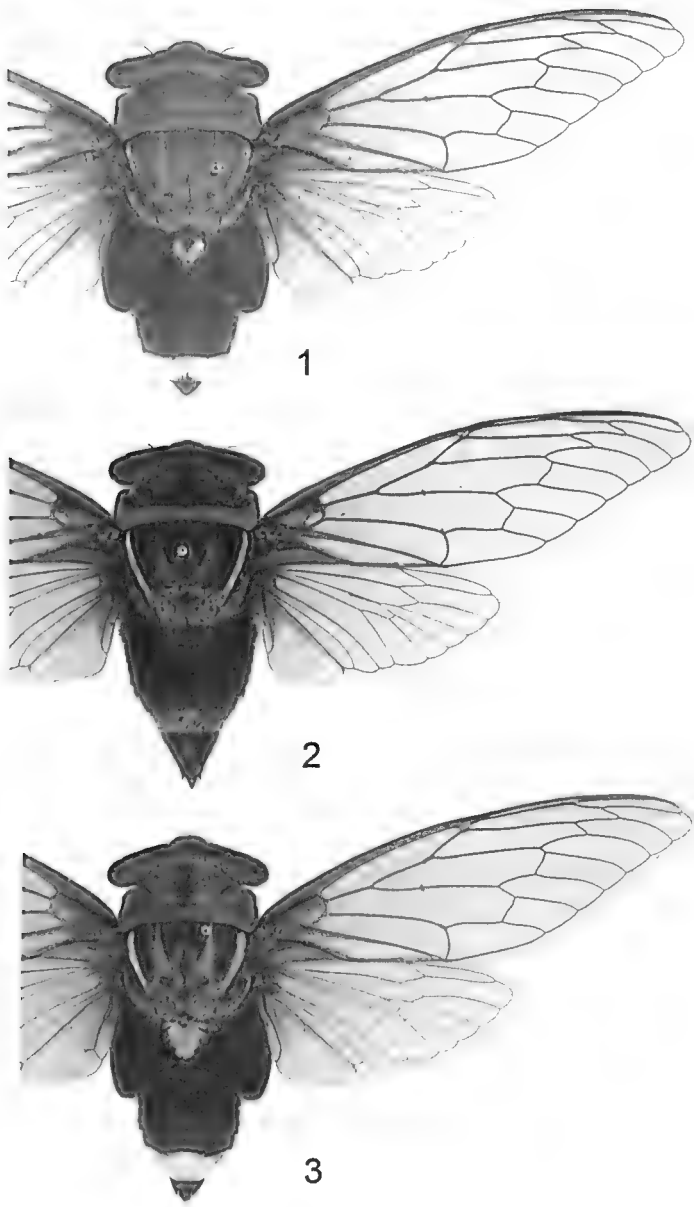
(Figs 1, 8-11)

Types. *Holotype* ♂, WESTERN AUSTRALIA: 55 km S of Exmouth, 8.iii.2004, P. Hutchinson (WAM). *Paratypes*: 1 ♂, Pinga Ck South, 135 km S of Port Hedland, 21°29.889'S, 118°43.935'E, 222 m, 11.ii.2006, Hill, Marshall, Moulds (AE) 1 ♂, same data (AM); 2 ♂♂, 1 ♀, same data (WAM); 1 ♂ (molecular voucher 06.AU.WA.PCS.01), 1 ♀, same data (MSM); 1 ♂, 1 ♀, ~40 km S of Newman, 23°44.412'S, 119°43.464'E, 624 m, 13.ii.2006, Hill, Marshall, Moulds (MSM); 1 ♂, 1 ♀, same data (WAM); 1 ♀, same data (AM); 2 ♂♂, 5 km N of Exmouth, 8.iii.2008, P. Hutchinson (PH); 2 ♂♂, 5 km S of Exmouth, 12.iii.2008, P. Hutchinson (PH); 1 ♂, 291 km S of Port Hedland, 22°37.771'S, 118°42.106'E, 707 m, 11.ii.2006, Hill, Marshall, Moulds (MSM); 1 ♂, nr Mt Robinson, 112 km NW of Newman, 23°03.386'S, 118°51.977'E, 12.ii.2006, Hill, Marshall, Moulds (MSM); 4 ♂♂, same data (WAM); 1 ♂, 13 km SE of Newman, 23°31.091'S, 119°46.216'E, 568 m, 13.ii.2006, Hill, Marshall, Moulds (MSM); 1 ♂, ~120 km S of Newman, 24°19.238'S, 119°42.330'E, 621 m, 13.ii.2006, Hill, Marshall, Moulds (MSM); 1 ♂, same data (WAM).

Description. Male (Figs 1, 8-10). Head pale muddy orange; vertex with a reddish brown fascia from eye to eye but terminating just short of each eye and ill-defined around ocelli; much of ventral surface reddish brown. Postclypeus mostly reddish brown, pale muddy orange dorsally. Anteclypeus reddish brown tending muddy orange laterally, dark reddish brown along midline, sometimes very dark apically. Lorum reddish brown with muddy yellow margin. Rostrum with mentum muddy orange; labium dark to very dark, dark reddish brown along groove, apical portion partly black; reaching almost to apices of hind coxae. Antennae with scape and pedicel reddish brown, the latter very dark to nearly black apically; flagellum black or nearly so.

Thorax. Pronotum pale muddy orange, the pronotal collar tending slightly paler; lateral margin of pronotal collar narrowly edged black. Mesonotum pale muddy yellow; an irregular reddish brown spot against distal inner margin of each anterior arm of cruciform elevation and usually a similar spot centrally at base of anterior arms; submedian and lateral sigilla ill-defined, but anterior outer corner of lateral sigillum usually marked by a small reddish brown mark; parapsidal sutures marked by a fine black line; silver pubescent band adjacent to wing groove, tapering posteriorly; lip of wing grove finely marked black on anterior half. Metanotum pale muddy orange. Thorax on underside dark reddish brown and muddy orange; extensively covered by fine white pubescence.

Figs 1-3. *Thopha* species: (1) *T. hutchinsoni* sp. n., male paratype from near Mt Robinson, Western Australia; (2) *T. sessiliba*, melanic female from Haliday Bay, Queensland; (3) *T. sessiliba*, male from 55 km NNE of Meekatharra, WA, *i.e.* west of the Great Sandy Desert. Approximately natural size.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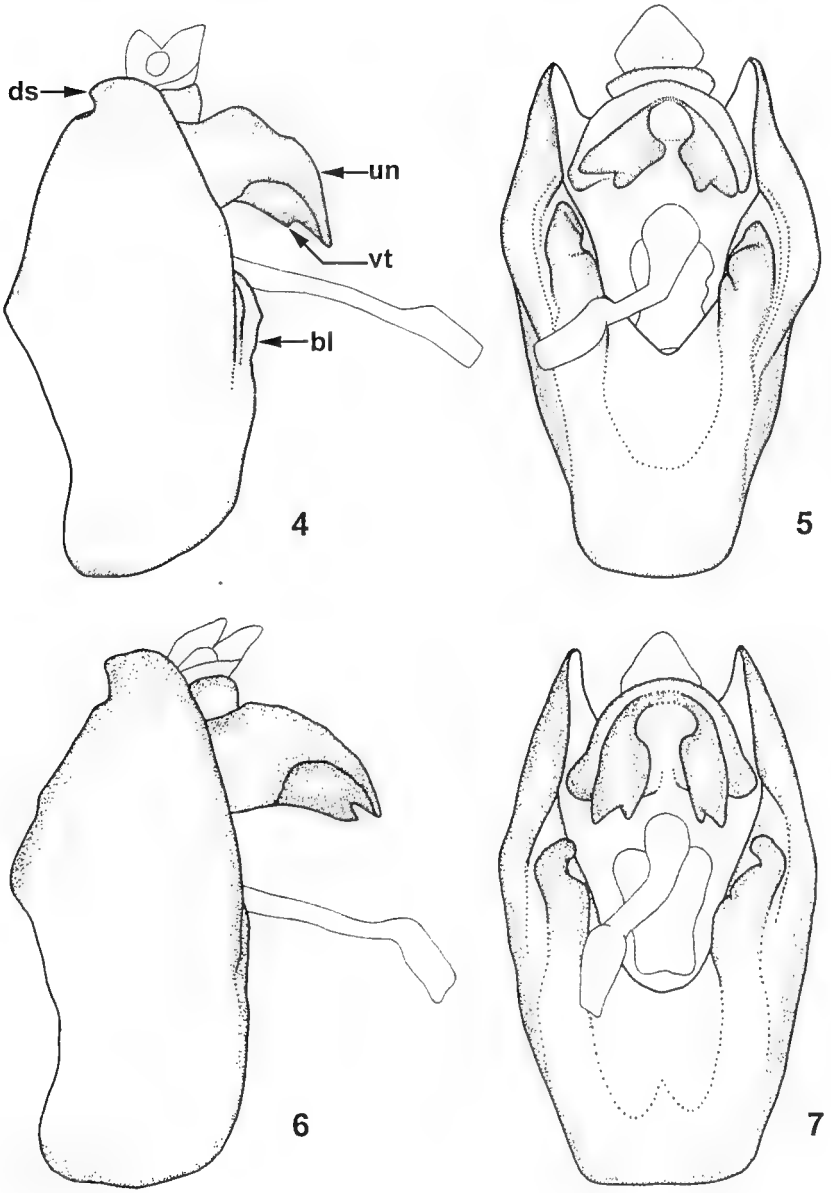
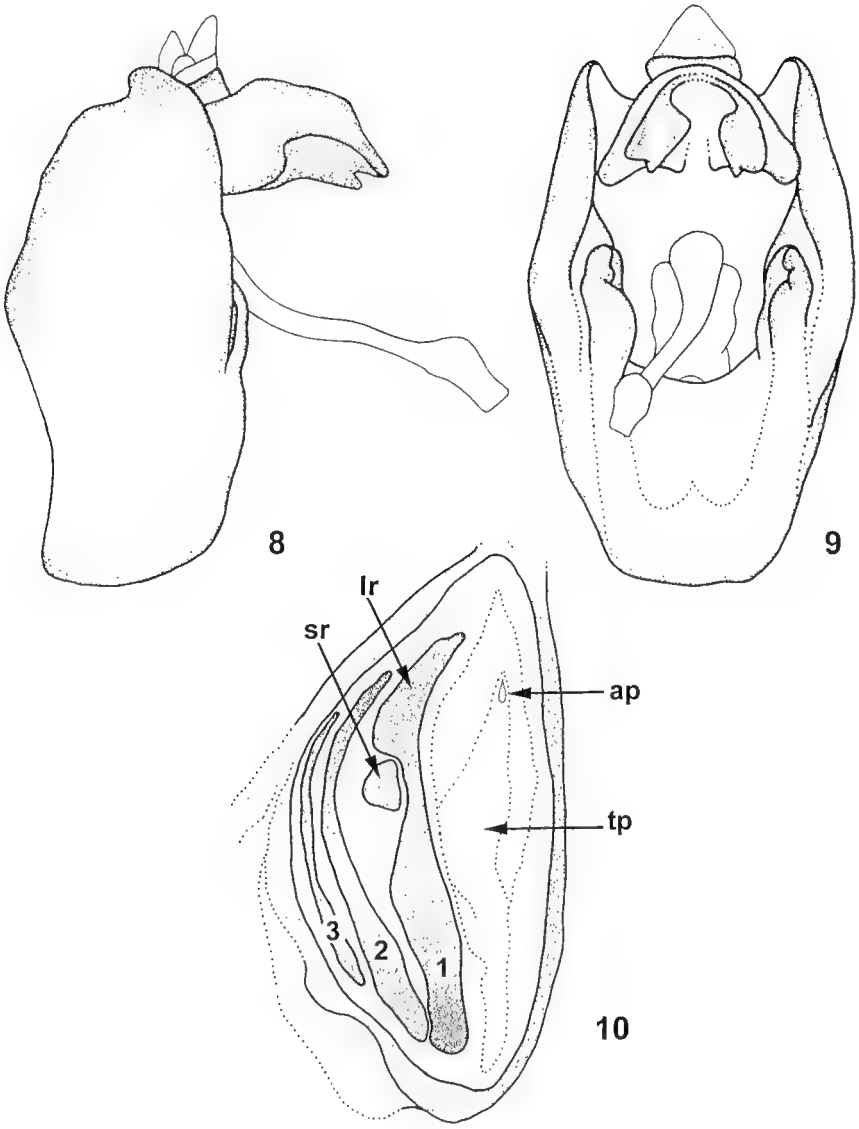


Figs 4-7. *Thopha sessiliba*, male genitalia: (4) lateral view, specimen from Conners R, SSW of Sarina, Queensland; (5) ventral view, same specimen; (6) lateral view, specimen from 146 km NNE of Meekatharra, Western Australia; (7) ventral view, same specimen. bl = basal lobe, ds = distal shoulder, un = uncus, vt = ventral tooth.



Figs 8-10. *Thopha hutchinsoni*, male genitalia and timbal: (8) male genitalia, lateral view, specimen from 40 km S of Newman, Western Australia; (9) male genitalia ventral view, same specimen; (10) left timbal showing the 3 long ribs and one short rib. ap = apodeme pit, tp = timbal plate, lr = long rib, sr = short rib, 1-3 = ribs one to three.

Wings hyaline and without infuscations. Fore wing venation pale muddy orange on basal half or so, otherwise mostly reddish brown; subcosta jet black along basal cell, jet black along 2A+3A in the vicinity of basal membrane. Basal cell opaque pale muddy orange but usually with a small window adjacent to CuA. basal membrane bright orange. Hind wing veins yellow or orange; plaga following CuP and 2A muddy orange sometimes tending blackish, following 3A mostly orange but sometimes mixed with black.

Legs dark reddish brown tending partly muddy orange. Coxae usually with dense white pubescence on outer face; fore coxae with muddy pale orange stripe for full length on outer face; mid and hind coxae usually tending pale orange. Fore femora with similar stripe, the pale orange also covering much of outer face abutting femoral spines. Pretarsal claws black on distal half or more.

Opercula dark reddish brown but usually covered by pure white pubescence, rim narrowly edged black.

Abdomen. Tergites dark reddish brown; tergite 2 with a large central patch of fine white pubescent 'dusting', epipleurites 3-7 usually with similar white pubescence to varying extent; tergite 8 usually completely covered by white pubescence. Sternites dark reddish brown; sternites I and II sparsely covered by white pubescence, usually most distinct on distal margin of II; anterior margin of sternite III and lateral extremities of sternites III-VII usually with a little white pubescence.

Timbals (Fig. 10). Timbal covers dark reddish brown, usually with dense, pure white pubescence below adjacent to rim. Timbals similar to those of other *Thopha* species; three long ribs, the first near the margin of the timbal plate, broad and irregular in shape, the second narrow, nearly parallel-sided and joined ventrally with first; the third narrow and nearly parallel-sided; one short, very broad rib between first and second long ribs.

Genitalia (Figs 8, 9). Distal shoulders of pygofer weakly developed with distal portion bluntly pointed and turned backwards. Pygofer basal lobes not well developed, broad and rounded in lateral view. Uncus deeply divided into a pair of long, gently-tapering, tooth-like lobes, in dorsal view diverging, in lateral view angled downwards at about 45°; ventral tooth (clasper) completely fused with uncal lobe except towards apex, in lateral view short, bluntly pointed, its apex set back a little from apex of uncus.

Female. Similar to male. Tergite 8 with mid dorsal region bearing dense silver pubescence, remainder covered by pure white waxy 'dusting'. Abdominal segment 9 black, tending dark reddish brown below, irregular orange patch laterally on distal half.

Measurements. Range and mean (in mm) for 10 males and 5 females; includes smallest and largest of available specimens. Length of body: male 46.3 - 51.3 (49.1); female 47.7 - 51.4 (49.5). Length of fore wing: male 56.3 - 64.0 (61.7); female 58.9 - 64.2 (61.2). Width of head (including eyes): male 20.4 - 23.0 (22.1); female 21.5 - 23.0 (22.3). Width of pronotum (across lateral angles): male 18.4 - 20.7 (19.8); female 19.1 - 20.8 (19.8).

Etymology. Named in honour of Paul Hutchinson, who collected the first specimens of this new species.

Distinguishing characters. Distinguished from all other *Thopha* species by the lack of bold, jet-black markings on the head and thorax in addition to having the sigilla of the mesonotum ill defined. Also differs from *T. sessiliba*, the species that is probably the most closely allied to *T. hutchinsoni*, in the lack of dark reddish brown pigmentation on the sigilla; those of *T. sessiliba* are always dark reddish brown and similar in colour to the dark fascia across the head between the eyes. These differences in colour are consistent between the two species across their ranges including where their known distributions are almost sympatric (Fig. 11), at which point there is no apparent change in landform or vegetation. Further collecting is likely to show that the two species are in fact sympatric.

It is interesting to note that, while *T. hutchinsoni* clearly differs from *T. sessiliba* in colour and markings (and to a lesser extent in size), I could find no differences in male genitalia. The apparent variation in uncal shape, position of the ventral tooth, shape of the distal shoulder, basal lobes and aedeagus (Figs 4-9) all fall within the range of individual variation within the two species. There is no doubt, however, that *T. hutchinsoni* and *T. sessiliba* are distinct species because the differences in colour and markings are considerable and consistent. The colour forms of *sessiliba* discussed below are essentially differences in background tone, not in the basic markings. For example, no matter how pale or dark individuals of *sessiliba* might be the sigilla and fascia joining the eyes are always distinctly and similarly coloured. This is not so in *hutchinsoni* where the fascia joining the eyes is always present but the sigilla are never similarly highlighted.

Distribution and habitat (Fig. 11). Confined to Western Australia, where it is known only from near Exmouth and the eastern fringe of the Pilbara region. From near Exmouth there are records from 55 km south of Exmouth on the east coast of the Exmouth Peninsula and from 5 km north and 5 km south of Exmouth. On the Exmouth Peninsula, Paul Hutchinson also has noted specimens from Mandu Mandu in Cape Range National Park, Mowbowra Creek 6 km south of Exmouth, Badjirrajirra Creek 22 km south of Exmouth and the Charles Knife Canyon, Cape Range. From east of the Pilbara specimens have been collected at several locations along the Great Northern Highway between 135 km south of Port Hedland and 120 km south of

Newman. Both regions are semi arid, receiving approximately 200-300 mm average annual rainfall that comes mainly as summer thunderstorms and cyclones.

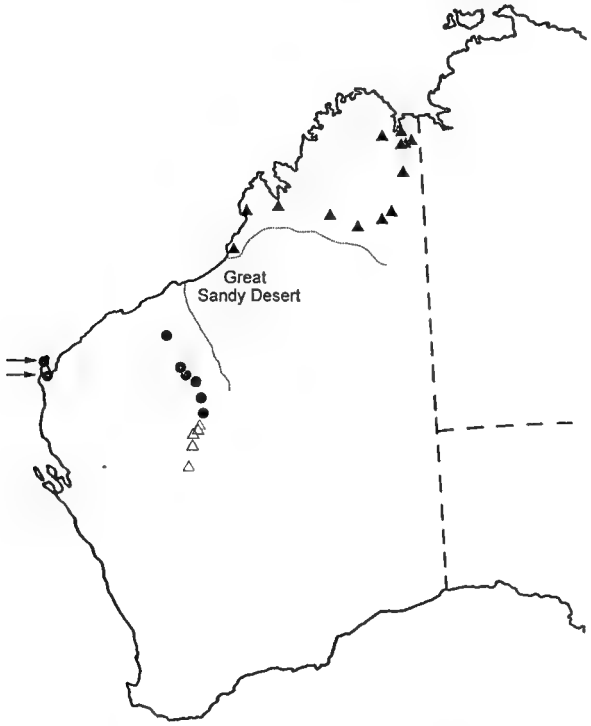


Fig. 11. Distribution of *Thopha hutchinsoni* sp. n. and *T. sessiliba* in Western Australia. Black dots indicate records of *T. hutchinsoni*, open triangles new records for *T. sessiliba* and closed triangles records from the previously known distribution of *T. sessiliba*.

Around Exmouth, adults usually frequent bloodwood, *Corymbia hamersleyana*, while east of the Pilbara they inhabit river red gums, *Eucalyptus camaldulensis*. Adults prefer the main trunk and limbs, sometimes perching high up near foliage. On the Exmouth peninsula they are restricted to stunted trees growing along ephemeral streams in limestone gullies emanating from the Cape Range. Along the Great Northern Highway the trees are taller and for the most part grow along sandy or stony stream banks that are tributaries of the Yule, Fortescue and Ashburton Rivers.

Adults frequently form communal aggregations, often with several occupying a single tree or group of adjacent trees. The larger a tree, usually the greater the aggregation within it. At times they can be approached relatively easily without alarm and sometimes can be taken by hand.

Adults emerge after heavy summer and early autumn rains and have been taken in mid February and early March. Because of this dependence upon heavy rain for emergence, combined with the unreliable nature of the rainfall, the appearance of adults is probably erratic.

Singing occurs during the heat of the day and at dusk. The song is a loud, drone-like whine, very similar to that of *Thopha saccata* as described by Moulds (1990). No recordings of the song are available for detailed analysis.

Relationships. Previously I discussed relationships among the then four known species of *Thopha* (Moulds 2001). *Thopha hutchinsoni* appears most closely related to *T. sessiliba.* The male genitalia of the two species are similar and what remains of the colour pattern of the head and thorax on *hutchinsoni*, that is the dark reddish brown fascia between the eyes and remnants of thoracic markings, is reminiscent of that of *sessiliba*, rather than the jet black markings of *T. saccata*, *T. emmotti* and *T. colorata.*

***Thopha sessiliba* Distant**

(Figs 2, 3, 4-7, 11)

New records. WESTERN AUSTRALIA: 1 ♂, 192 km N of Meekatharra, 7.iii.2006, P. Hutchinson; 1 ♂, 146 km N of Meekatharra, 7.iii.2006, P. Hutchinson; 1 ♂, 57 km N of Meekatharra, 6.iii.2006, P. Hutchinson (PH); 1 ♂, ~167 km S of Newman, 24°42.759′S, 119°36.513′E, 607 m, 13.ii.2006, Hill, Marshall, Moulds; 1 ♂, 210 km S of Newman, 25°01.126'S, 119°24.560'E, 559 m, 13.ii.2006, Hill, Marshall, Moulds; 1 ♀, ~221 km S of Newman, 25°06.355'S, 119°22.369'E, 545 m, 14.ii.2006, Hill, Marshall, Moulds; 1 ♂, 1 ♀, 146 km NNE of Meekatharra, 25°35.579'S, 119°14.173'E, 545 m, 14.ii.2006, Hill, Marshall, Moulds; 1 ♂, 1 ♀, 55 km NNE of Meekatharra, 26°08.225'S, 118°41.721'E, 478 m, 14.ii.2006, Hill, Marshall, Moulds (MSM); 1 ♂, ~221 km S of Newman, 25°06.355'S, 119°22.369'E, 545 m, 14.ii.2006, Hill, Marshall, Moulds (WAM). NEW SOUTH WALES: 1 ♂, 64 km N of Lightning Ridge turnoff, 29°13.680'S, 147°52.475'E, 161 m, 24.i.2005, Hill, Marshall, Moulds (MSM).

The new records listed above show that *T. sessiliba* is widespread in Western Australia west of the Great Sandy Desert. Previously, there was just a single record from this region (Burns 1962, Moulds 1990), from Mundiwindi, but I have been unable to trace this specimen. Because Mundiwindi is close to the known distributions of both *T. sessiliba* and *T. hutchinsoni*, the identity of the specimen(s) is now in doubt so the record is disregarded here. The record from near Lightning Ridge in New South Wales extends the distribution of *T. sessiliba* a little further west in that State.

Distribution and colour of *Thopha sessiliba*

T. sessiliba is now known to be distributed across much of northern Australia from the headwaters of the Gascoyne and Murchison Rivers in Western Australia and from Nita Station (south west of Broome) to the Kimberley region of Western Australia (Fig. 11), across much of the Northern Territory to northern and eastern third of Queensland and in New South Wales along the inland margin of the Western Slopes south to Narrabri (Moulds 1990, 2001, and records from this paper).

A little south west of Nita Station the Great Sandy Desert ceases to support eucalypts and *T. sessiliba* almost certainly does not occur there. Thus, there is a distinct and significant gap in the distribution of *T. sessiliba* across this desert barrier. Specimens from east of this desert are typical *sessiliba* in colour and pattern (see Moulds 1990: pl. 7) while those from west of the Great Sandy Desert are distinctly different (Fig. 3). Western individuals have the head, pronotum and mesonotum similar in colour to the pronotal collar whereas typical *sessiliba* have the pronotal collar distinctly paler. The midline of the pronotum is always boldly marked by a broad dark reddish brown fascia that is rarely present in typical *T. sessiliba.* Further, the dark reddish brown fascia across the head between the eyes terminates just before the eyes, whereas this fascia nearly always meets the eyes in typical *T. sessiliba.*

It is possible that these western *sessiliba* are a different species but I am reluctant to describe them as such without more convincing differentiation. I could find no clear differences in male genitalia and there are no other structural differences apart from a tendency to be slightly larger. A study of DNA or song structure may show sufficient differences to justify species status but this information is lacking at present.

Thopha sessiliba from east of the Great Sandy Desert, the so-called typical *T. sessiliba*, show variation in colour tone across their distribution. I have previously documented how individuals darken as one goes north from about Coen on Cape York Peninsula (Moulds 1990: 57, pl. 7, fig. 2b) and how individuals west of about the Great Dividing Range in Queensland and through the Northern Territory and Western Australia are paler than specimens from eastern Queensland (Moulds 1990: 57, pl. 7, figs 2, 2a). Since that time a population of melanic individuals (Fig. 2) has been discovered by A.J. Emmott at Haliday Bay, north of Mackay (20°54'S, 148°59'E). Three males were collected on 2 January 2001, all similarly melanic. They are clearly darker than the darkest individuals from Cape York Peninsula. A single, even darker, specimen has been taken by Mark Lane near Chillagoe (17°03'S, 145°21'E) but this was a single melanic individual amongst an otherwise normal population. It is important to note that none of these melanic specimens have any markings jet black, but rather there is an overall darkening of all the normal body markings and pigmentation.

Key to *Thopha* species

The key to species of *Thopha* in Moulds (2001: 196) can be modified to include *T. hutchinsoni* and the western form of *T. sessiliba* by the following modification of couplet 1.

1 Head and thorax with bold, jet-black markings 2

– Head and thorax lacking bold, jet-black markings 1a

1a Mesonotum with thoracic sigilla ill-defined ..... *hutchinsoni* sp.n.

– Mesonotum with thoracic sigilla boldly marked reddish brown 1b

1b Pronotum with midline always boldly marked reddish brown *and* colour of pronotal collar similar to remainder of pronotum .... 'western' *sessiliba*

– Pronotum rarely with midline boldly marked reddish brown, *if so* then colour of pronotal collar obviously paler than remainder of pronotum ..... 'typical' *sessiliba*

Australia's largest cicada

The largest Australian cicada species has been regarded as *Thopha saccata*, with the largest specimen having a forewing length of 66 mm and a wingspan of 144 mm (Moulds 1990). I now have a larger specimen with a forewing length of 67 mm and a wingspan of 151 mm. The discovery of two further large species of *Thopha*, *T. emmotti* (Moulds 2001) and now *T. hutchinsoni*, necessitates a review of what is Australia's largest cicada.

At the time of description of *T. emmotti* there were only 20 known specimens and the largest attained a forewing length of 61.8 mm, less than the largest known specimen of *T. saccata*. Since that time additional specimens have been collected but the largest of these was only marginally larger.

Specimens of *T. hutchinsoni* tend to be larger than those of *T. emmotti* but, with a maximum forewing length of 64.2 mm and a maximum wingspan of 145 mm, they fail to eclipse the largest *T. saccata*. However, the known number of specimens is not great and it is likely that larger specimens will be found in the future.

Thus, for the time being at least, *T. saccata* remains the largest Australian species, measured by forewing length and wingspan. *T. saccata* is also the heaviest cicada; the dry weight of the largest specimen of *T. saccata* (a female) is 2.14 gm while that of *T. hutchinsoni* (also a female) is 1.81 gm.

Widest head

The genus *Thopha* belongs to a lineage of cicadas that includes a number of genera with very wide heads (Moulds 2005: 412). These exceptionally wide heads are a result of elongation of the vertex and does not directly relate to the overall size of the species. For example, the world's largest cicada,

Pomponia imperatoria (Westwood), has a relatively narrow head. On the other hand, *Thopha* species are not only large cicadas but also possess wide heads. The head width of the largest *T. saccata* specimen is 21.5 mm but that of the largest *T. hutchinsoni* measures 22.5 mm, surpassing that of *T. saccata* by 1 mm. Remarkably, this is not only the widest head of any Australian cicada species, but the widest of any cicada in the world. Interestingly, it also has the widest head of any Australian insect.

Acknowledgements

I thank Paul Hutchinson for the loan of specimens of this new species in his collection and for helpful comments on habitat and behaviour. Dr A. Ewart provided valuable comments on the manuscript. Angus Emmott kindly provided specimens of the melanic population of *T. sessiliba* from Haliday Bay. Mark Lane provided access to his melanic specimen of *T. sessiliba*. Kathy Hill and Dave Marshall assisted in field work collecting the new Western Australian records. Figures 6-10 were drawn by Ivan Nozaic and figures 4-5 by Sally Beech; to both I give my sincere thanks. The Department of Conservation and Land Management provided permits to collect specimens in Western Australia. I am grateful to Peter Lillywhite (Museum of Victoria), Terry Houston (Western Australian Museum) and Mick Webb (The Natural History Museum, London) for answering enquiries regarding specimens in their care.

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LIFE HISTORY NOTES ON *BRACCA ROTUNDATA* (BUTLER) (LEPIDOPTERA: GEOMETRIDAE) AND *OXYCOPHINA THEORINA* (MEYRICK) (LEPIDOPTERA: THYRIDIDAE)

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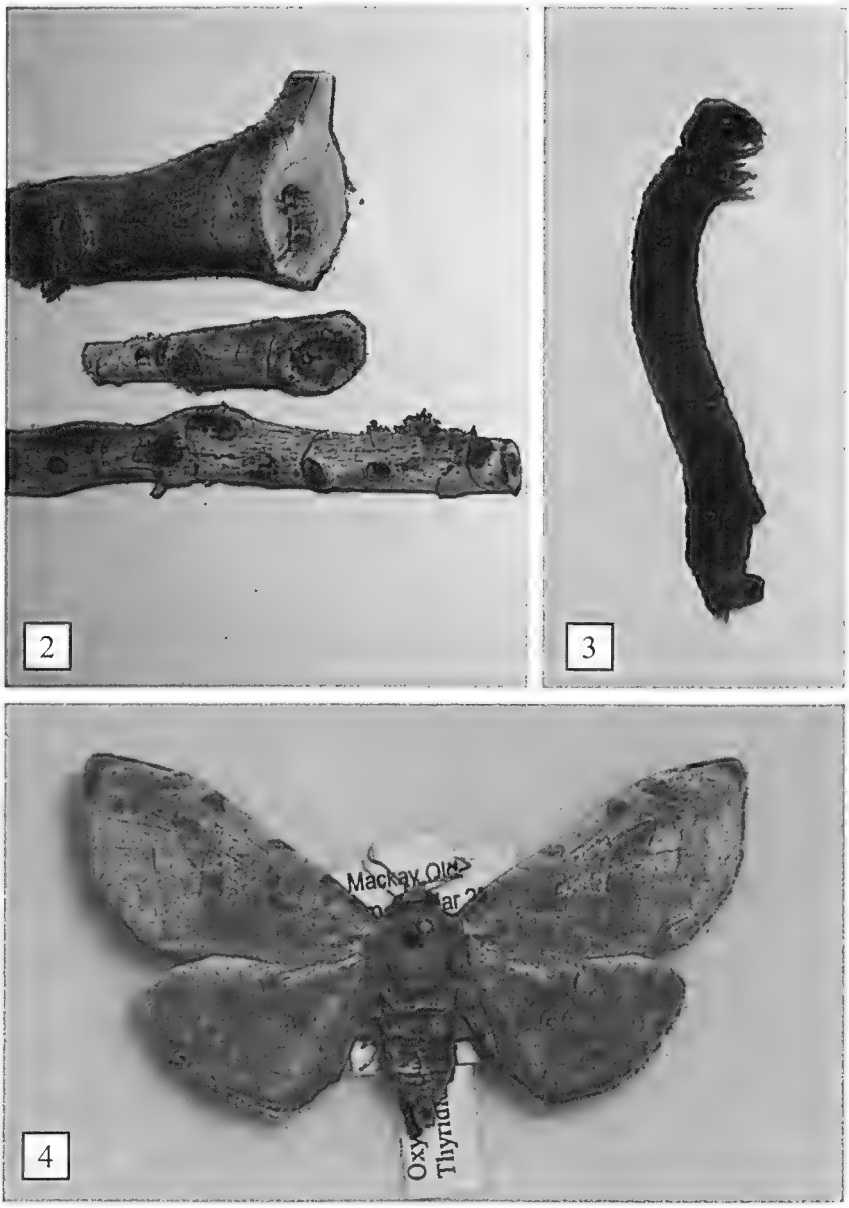
Abstract

Life history notes are presented and larvae illustrated for *Bracca rotundata* (Butler) and *Oxycophina theorina* (Meyrick) from northern Queensland. Recorded food plants are *Austrobaileya scandens* C.T. White (Austrobaileyaceae) and *Macaranga tanarius* (L.) J. Muell. (Euphorbiaceae) respectively.

Introduction

Currently, nothing is known of the early stages or food plant of the geometrid moth *Bracca* (= *Tigridoptera*) *rotundata* (Butler) (Zborowski and Edwards 2007, Common 1990), or of the habits or biology of *Oxycophina theorina* (Meyrick), the largest of the Australian thyridid moths (Zborowski and Edwards 2007, Common 1990, E.D. Edwards pers. comm.). The following notes and illustrations are based on material from northern Queensland.

Fig. 1. *Bracca rotundata* larva.



Figs 2-4. *Oxycophina theorina.* (2) *Macaranga tanarius* stems showing stem damage and borer holes; (3) larva; (4) adult.

Life history notes

GEOMETRIDAE

Bracca rotundata (Butler)

(Fig. 1)

Material examined. QUEENSLAND: 2 specimens, Paluma, pupated 25.xii.1983, emerged 11.i.1984, M. De Baar and M. Hockey.

Comments. Two larvae were collected on 16 December 1983 at Paluma, feeding on *Austrobaileya scandens* C.T. White (Austrobaileyaceae), a vine in rainforest. The larvae were black with white and orange markings (Fig. 1). *Austrobaileya scandens* is a primitive vine, up to 15 m in height and endemic to northern Queensland rainforests; it is the only species included in the family Austrobaileyaceae.

THYRIDIDAE

Oxycophina theorina (Meyrick)

(Figs 2-4)

Material examined. QUEENSLAND: 1 ♂, Mackay, from several larvae collected 2.ii.2001, emerged from pupa 26.iii.2001, B. Delaney.

Comments. During the summer of 2000-01, Mackay City Council obtained potted stock of *Macaranga tanarius* (L.) J. Muell. (Euphorbiaceae) from Normanton in NW Queensland for street plantings. Following planting, several trees about 2 m high showed stem damage. In February 2001, Brian Delaney sent several of these stems to me and, on examination, they showed swellings and borer holes (see Fig. 2). Larvae (Fig. 3) were feeding inside the stems. The stems were kept in the Queensland Department of Primary Industries and Fisheries insectary in Brisbane and a male (Fig. 4) emerged on 26 March 2001. It is not known if the trees became infested in Mackay or in Normanton.

Acknowledgements

I thank Dr Gordon Guymer for assistance with the identification of *Austrobaileya scandens*, Brian Delaney (Mackay City Council) for sending material and Dr Judy King for her support of my projects and her comments on the manuscript.

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A NOTE ON SOME HAWAIIAN SPECIES OF *TRUPANEA* SCHRANK (DIPTERA: TEPHRITIDAE: TEPHRITINAE)

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Abstract

Trupanea nigripilosa (Hardy), comb. n. and *T. paludosae* (Hardy), comb. n. are transferred from *Neotephritis* Hendel and placed in a species complex with *T. denotata* Hardy.

Introduction

Trupanea Schrank is a cosmopolitan genus of some 215 described species of tephritid flies that infest the flowerheads, shoots or stems of various genera of Asteraceae. At least 25 species (2 undescribed) occur in the Hawaiian Islands, including two currently placed in the New World genus *Neotephritis* Hendel. However, all the endemic Hawaiian tephritines are believed to have arisen from a single ancestor (Hardy and Delfinado 1980, Brown *et al.* 2006) and the endemic genus *Phaeogramma* Grimshaw is likely to be a synonym.

Discussion

Trupanea nigripilosa (Hardy), comb. n. and *T. paludosae* (Hardy), comb. n., both from Maui, were suggested to belong here by Hancock and Drew (2003), who removed them from *Neotephritis*; the male distiphallus is typical of *Trupanea*. They differ from all other *Trupanea* species in the presence of four scutellar setae rather than two and appear to form a species complex with *T. denotata* Hardy, also from Maui. All three species have the scutum almost entirely black-microsetose and similar wing patterns with numerous spots and faint brown costal cells. The only confirmed host is *Argyroxiphium virescens* with *T. denotata*, at least, infesting the growing tips.

Contrary to the molecular phylogeny produced by Brown *et al.* (2006), the *T. denotata* complex does not appear to be closely related to either *T. limpidapex* Hardy or their *T.* sp. A, both also from Maui. *T. limpidapex* appears to be the sister-species of *T. pantosticta* Hardy from Hawaii; both infest the shoots of *Dubautia* spp. but have the scutum covered with scale-like, yellowish microsetae and short, long-setose male fore basitarsi. *T.* sp. A appears to be the sister-species of *T. joiceyi* Hardy from Oahu and Molokai; both form stem galls on *Dubautia*. The *T. denotata* complex shares many characters, including the elongate and short-setose male fore basitarsi, with *T. nigripennis* Hardy and *T. marginalis* Hardy from the island of Hawaii.

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ALEUROCLAVA BAGAHFORMIS, A NEW SPECIES OF WHITEFLY (HEMIPTERA: ALEYRODIDAE) FROM SOUTHEASTERN QUEENSLAND

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Abstract

Aleuroclava bagahformis sp. n. is described from material collected from rainforests of southeastern Queensland. It has been found on the leaves of *Alangium villosum* (Alangiaceae) and represents the second species of this genus described from Australia. The unusual shape of the puparium and its systematic placement are discussed.

Introduction

Recent research by several workers has continued to throw light on the diverse Australian whitefly fauna (Martin 1999, Gillespie 2006, M. Coombs pers. comm.). The subtropical rainforests of southeastern Queensland have been the site of some recent collections of unique and interesting whitefly taxa, of which the new taxon described here forms a small part. Several of the newly discovered taxa have been found in relationship with only one host. Given the diverse nature of Australia's flora and the lack of attention given to whiteflies on Australian plants, this suggests that the Australian whitefly fauna may contain two to three times the present number of described species.

The genus *Aleuroclava* Singh is a large and diverse Asian genus of often small whiteflies. This genus is not well known from Australia, with presently only one described and a number of undescribed species recognised (Martin 1999). A new species is described below from specimens collected in southeastern Queensland. This taxon has a very small, dark puparium of a highly unusual nature, with a rectangular cephalothorax and a long, thin abdomen. These features, in combination with other characters such as the granular dorsum, lack of dorsal setation and features of the thoracic and abdominal tracheal pores, show most affinities with the genus *Aleuroclava* in which it is placed.

Methods

All slide mounted specimens are preserved in Canada Balsam mountant using the method outlined by Martin (1999). Database accession number for NSW DPI deposited specimens is indicated in brackets following specimen details. Type material is deposited in repositories as listed below. Photomicrographs were taken with a Micropublisher 5 RTV digital camera (QImaging) attached to a Leica MZ12.5 dissecting microscope and montaged images produced with AutoMontage Pro (Synchroscopy P/L). Abbreviations used in this paper include: ANIC – Australian National Insect Collection, whitefly collection;

ASCU – Agricultural Scientific Collections Unit, NSW DPI, Orange; BMNH – The Natural History Museum, London; Qld – Queensland.

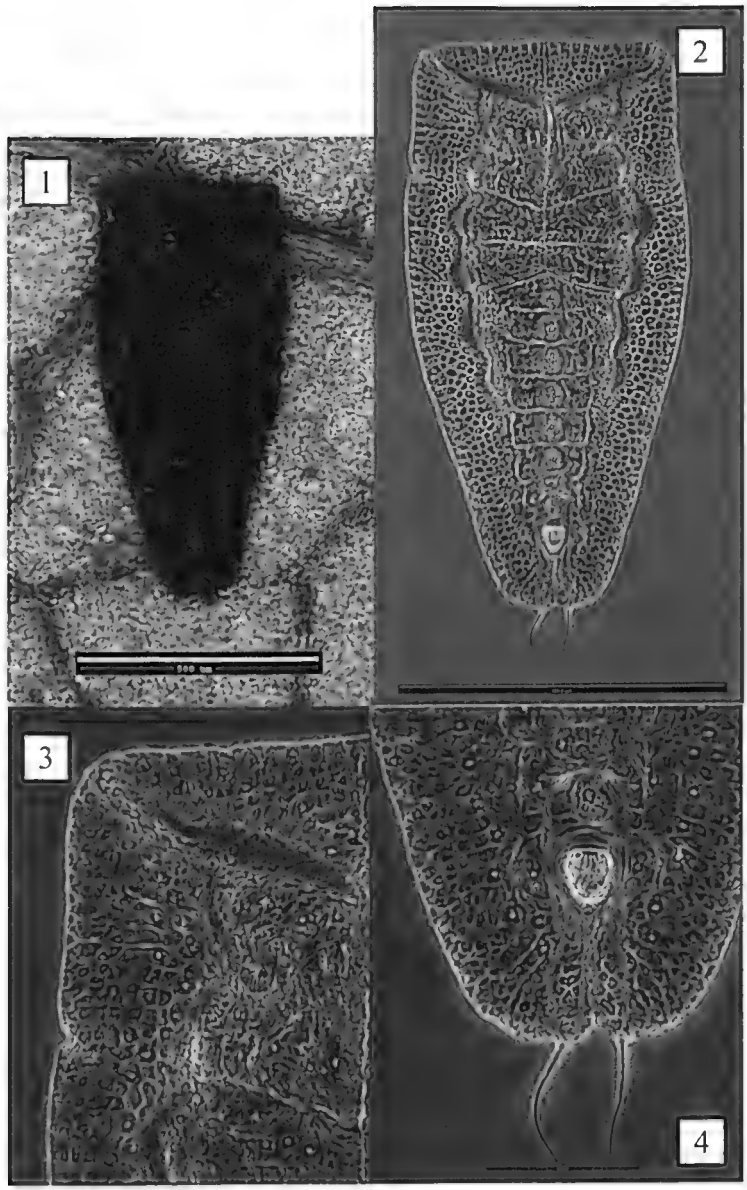
Aleuroclava bagahformis sp. n.

(Figs 1-6)

Material examined. Holotype puparium on slide, QUEENSLAND: ex *Alangium villosum*, '3 stumps', D'Aguilar N.P., 28.ix.2006, P.S. Gillespie & B.C. McNeil (ASCT00132260) (ASCU). *Paratypes*: 2 emerged pupal cases each on a slide, host unstated, '3 Stumps', Mt Glorious, 8.xii.2006, B.C. McNeil & M. Coombs. (ANIC, BMNH); 2 puparium slides ex *Alangium*, Mt Glorious, 7.ii.2007, M. Coombs & B.C. McNeil (ASCT00047573 (DNA=AM1928), ASCT00047541 (DNA=AM1929) – ASCU); 1 puparium on dry leaf, same data as holotype (ASCT00132255 - ASCU); 5 puparia (3 parasitized) each on leaf fragment, ex *Alangium*, Mt Glorious, 7.ii.2007, M. Coombs & B.C. McNeil (ASCT00132126 - ASCU).

Description. Puparium (Figs 1, 6) small, black, heavily sclerotised and requiring bleaching for viewing; shield-shaped with cephalothorax approximately rectangular in appearance. Pupa with a covering of fine, clear wax and lacking peripuparial wax. Some specimens with a distinctive transverse whitish stripe on dorsum between the thoracic tracheal pores and the moulting sutures and also with some small white markings on abdomen, particularly in the area of segment VII medially but the extent of these white markings varies considerably from specimen to specimen (Fig. 6). Puparia do not appear dimorphic. Length of pupa 890-1,100 µm, width 400-540 µm; widest at metathoracic segment (Figs 1, 2, 5).

Dorsum: Puparium with more or less rectangular cephalothorax with anterolateral corners defining their anterior and lateral aspects (Figs 2-3). Anterior margin of cephalothorax straight and perpendicular to longitudinal axis of pupa. Apart from thoracic tracheal pores, lateral margins of cephalothorax straight and parallel to longitudinal axis of pupa. Abdomen elongate, narrowed and straight-sided (Figs 2-3). Margin not defined from subdorsum. Margin irregularly and finely crenulate with invaginations at thoracic and caudal tracheal openings. Thoracic tracheal invaginations shallow (wider than distance from margin) and with 4 or 5 finer crenulations. Puparium covered with coarse granules or rugosities. A pair of submedial folds or elevated extensions running longitudinally overlying the legs in the cephalothorax and the anterior part of the abdomen are present; these extend from anterolateral corner of pupa to abdominal segment IV (Figs 2-3). A raised ridge/submedial fold of rugose nature running parallel to anterior margin joins longitudinal folds anterolaterally in the cephalus (Fig. 3). Single large, course tubercle present medially on abdominal segments I-VIII (Figs 2, 3, 5). Abdominal segments sparingly defined medially although rugosity, elevation and medial tubercle of each segment masking slight rhachisiform shape. Abdominal segment VII little more than half the length of the preceding segment. Simple pores sparsely scattered over cephalothorax and



Figs 1-4. *A. bagahformis* puparium. (1) puparium habitus (holotype); (2) puparium slide; (3) cephalothorax detail; (4) abdomen detail. (Scale bars 1, 2 = 500 μm; 3, 4 = 100 μm).

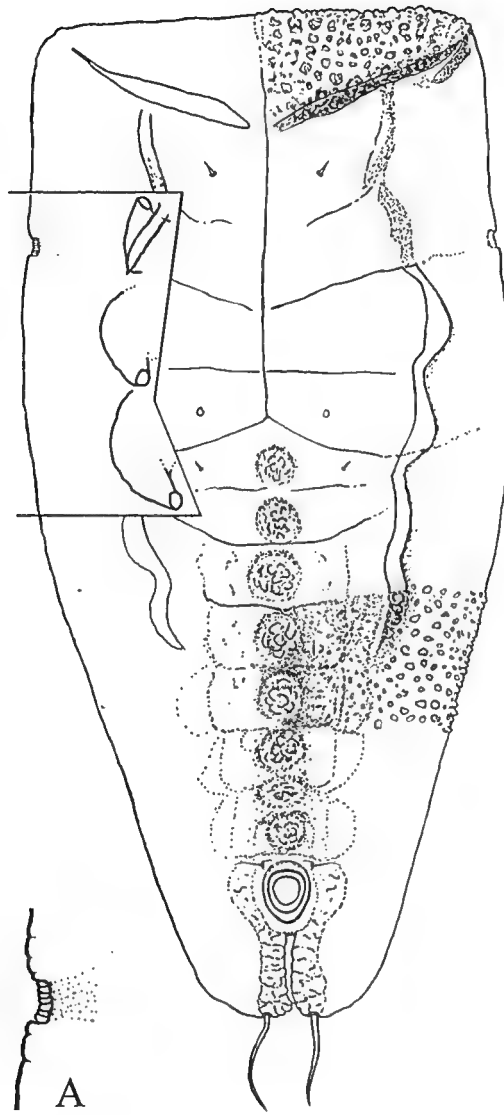


Fig. 5. *A. bagahformis* puparium drawing. (Scale bar = 500 μm). (A) = ventral detail of cephalothoracic tracheal pore.

abdomen. Narrow caudal furrow present (Fig. 4). Vasiform orifice rounded chordate, not elevated above dorsum and appearing to be set into a narrow, elevated rugose plateau extending posteriorly to the margin and bordering the caudal furrow (Fig. 4). Posterior margin of plateau between vasiform orifice and caudal furrow with a few narrow and coarsely serrate teeth. Interior margin of vasiform orifice with scalloping. Operculum slightly longer than wide, of rounded quadrilateral shape, filling anterior two thirds of vasiform orifice. Lingula enclosed and obscured by opercula. Vasiform orifice situated two or more lengths (90 μm) from posterior margin (Fig. 4).

Chaetotaxy: Anterior and posterior marginal setae present as minute, fine setae, those of the anterior margin being in the anterolateral corners of the cephalothorax. Cephalothoracic seta present and short (35 μm). First abdominal setae present and short (20 μm) and set more than five setal lengths apart from each other. Eighth abdominal setae present and twice as long as first abdominal setae (44 μm), situated anterolateral to vasiform orifice. Caudal setae long (85 μm) and situated on posterior margin close together (30 μm apart). No other dorsal setae present.

Venter: Antenna short, only reaching to base of fore leg and situated immediately anterior to the fore leg (Fig. 5). Ventral abdominal setae short (20 μm) and situated slightly mesad of the vasiform orifice. Mid and hind legs with small seta at the base. Thoracic tracheal folds present as a small number of short, linear striations present mesad of invagination (Fig. 5). Detail of much of the venter, particularly in caudal region, difficult to discern due to highly rugose nature of dorsum.

Etymology. Latinised noun; *bagah* is an Aboriginal (Bunjalung) word for shield, referring to the distinctive shape of the puparium.

Host plant. *Alangium villosum* (Blume) Wangerin (Alangiaceae); Muskwood, a rainforest tree.

Comments. *Aleuroclava bagahformis* is found singly on the undersides of the leaves of the host tree. This distinctive species is unlikely to be confused with any other. The squared-off nature of the cephalothorax, the heavy rugosities on the dorsum, the diminutive size and the series of abdominal medial tubercles immediately distinguish this species from all other Australian whiteflies.

Discussion

Although the nature of the legs and lack of compound pores clearly places *A. bagahformis* within the subfamily Aleyrodinae, this species shows such an irregular morphology that initial generic placement was difficult. Examination of the works by Martin (1985, 1988, 1999), Dumbleton (1956, 1957, 1961a, 1961b) and Corbett (1933, 1935a, 1935b, 1935c, 1936) of the whitefly fauna of Australia and neighbouring regions shows that there are no taxa similar to *A. bagahformis* known so far from those regions.

Fig. 6. *A. bagahformis* puparium habitus. (Scale bar = 500 μm)

The invaginated thoracic and caudal tracheal pores of *A. bagahformis* are a character shared with species of *Dialeurodes* Cockerell, *Gomonella* Dumbleton, *Dialeurolonga* Dozier and *Aleuroclava* Singh. The new taxon differs from species of *Dialeurodes* and *Dialeurolonga* by being smaller, less rounded and darkly pigmented, characters often found in *Aleuroclava.* Further, the vasiform orifice of *Dialeurolonga* is often more elongate, with the opercula not fully occupying it, often leaving the lingula partially exposed. In the case of *Dialeurodes* the vasiform orifice is often chordate, small and removed some distance (usually greater than three vasiform orifice lengths) from the margin, features not found in *Aleuroclava* or this taxon. *A. bagahformis* lacks a concentric submarginal dorsal fold, a character that typifies *Gomonella*, although this sometimes is found in some other species of *Aleuroclava.* The highly sculptured dorsum of this species is also found in some other species of *Aleuroclava.*

DNA extracted from the holotype prior to slide mounting may be used in future to provide evidence of the affinities of this taxon. The discovery of such an unusual taxon provides evidence of the unique character and diversity of the Australian whitefly fauna and also highlights the often highly host specific nature of many endemic whitefly species. A more systematic approach to the collection of endemic whiteflies will undoubtedly show that there are many other new and unusual whitefly taxa awaiting discovery.

Acknowledgements

Mr B. McNeil is acknowledged as the discoverer of this species and is thanked for his enthusiastic and skilled collecting of whiteflies. Dr M. Coombs is thanked for the loan of specimens, his valued advice on whiteflies and his ever reliable botanical skills.

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NOTES ON THE LIFE HISTORY OF THE WESTERN XENICA *GEITONEURA MINYAS* (WATERHOUSE & LYELL) (LEPIDOPTERA: NYMPHALIDAE: SATYRINAE)

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Abstract

The life history of the Western Xenica, *Geitoneura minyas* (Waterhouse & Lyell), is described and illustrated. The introduced annual veldt grass *Ehrharta longiflora* Smith is a frequently used food plant at Wanneroo. The relationship between *G. minyas* and *G. klugii* (Guérin-Méneville) in southwestern Australia is discussed.

Introduction

The Western Xenica, *Geitoneura minyas* (Waterhouse & Lyell), is endemic to southwestern Australia (Braby 2000). It is locally common from near Albany (Burns 1951) and the Stirling Range (Common and Waterhouse 1981) north to Shark Bay and inland to the semi-arid zone around Paynes Find (Williams *et al.* 1993) and the Koolyanobbing Range (Williams *et al.* 1996).

In the northern part of its range *G. minyas* flies in August but further south, near Dunsborough and Albany, adults do not generally appear until October and continue flying until late November. Apart from the description of a larval head capsule and pupa based on colour transparencies (Braby 2000), its life history is poorly known. In this paper, its life history is described and compared with that of the closely related *G. klugii* (Guérin-Méneville).

Life history

Food plant. The introduced *Ehrharta longiflora* Smith (South African annual veldt grass) (Poaceae).

Egg (Fig. 1). Diameter 0.7 mm; dome-shaped, uniformly greenish-white when first laid, turning yellowish with variable pink markings after a few days; surface with 12-14 prominent vertical ribs culminating in a circular crown of raised projections around the apex; micropyle area flattened with an indistinct reticulated pattern of fine ridges.

First instar larva (Fig. 2). Length 2-5 mm. Head large and rounded, shiny black, faintly pitted and sparsely covered with long, curved pale setae rounded at tips. Body slender, cream in colour, with distinct pink-brown mid-dorsal line, two pink-brown dorsolateral lines and one usually broken ventrolateral line; a series of paired, long, curved black setae (Fig. 3) are

located along each side of mid-dorsal line as well as numerous shorter lateral setae; the tips of these setae are white and slightly clubbed; dorsal collar projections support forward curved black setae. As the larva grows it turns green and the pink-brown mid-dorsal and dorsolateral lines become less well defined.

Second instar larva. Length 5-9 mm. Head green, rounded, faintly pitted and sparsely covered with long black primary setae and shorter pale secondary setae; eyes small and black. Body long and slender, green in colour with darker green mid-dorsal line and two green dorsolateral lines; when viewed from above the strip between the dorsolateral lines appears yellowish green; paired black setae are located along each side of the mid-dorsal line and there are numerous shorter, white lateral setae; anal segment with short forked posterior projection.

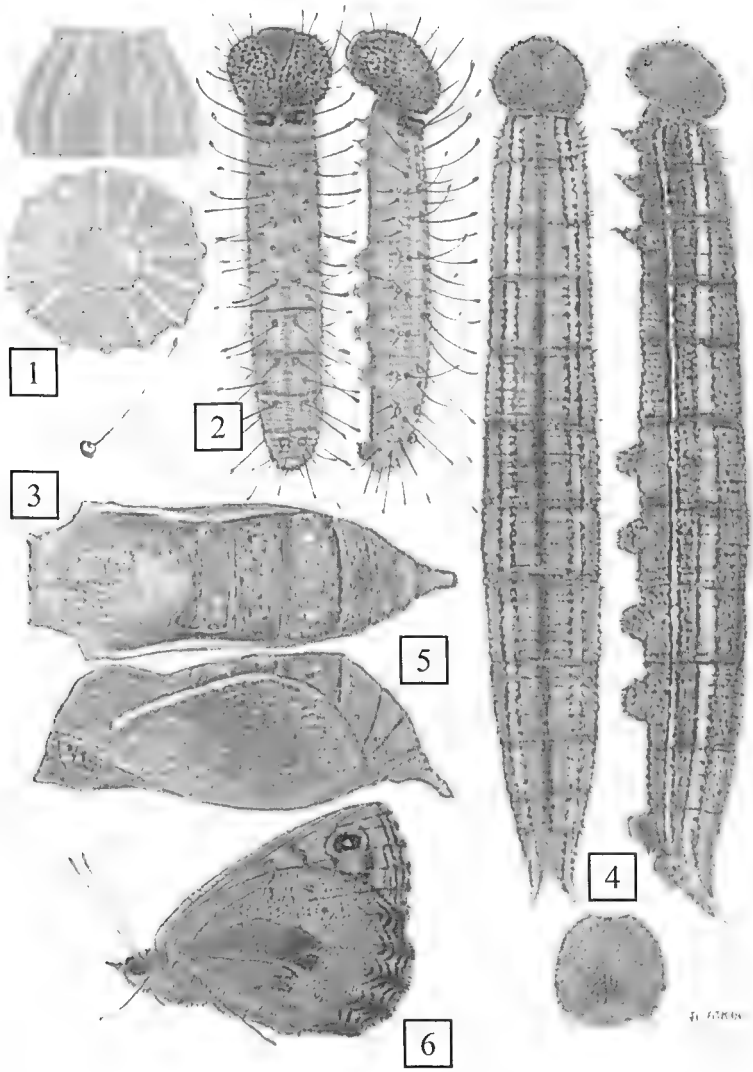
Third to final instar larva (Fig. 4). Length 10-26 mm. Head green; large and rounded; surface covered with small white nodules from which protrude fine black or pale, pointed setae. Body green; long and tapered; covered with very short, fine white setae; dorsal surface with occasional black, pointed setae; green sclerotised collar behind head supports longer, pointed black setae; there is a prominent, dark green mid-dorsal line and a narrow whitish dorsolateral line, edged darker green, which extends the length of the body, including sides of the forked posterior projection. Mature larvae have a narrow but distinct white ventrolateral line.

Pupa (Fig. 5). Length 11-12 mm. Colour variable, either green or greenish blue with pinkish-blue translucent wing cases, or brown; anterior end wedge shaped; thorax with pronounced dorsal ridge; dorsal margin of forewing with a cream longitudinal ridge edged above with dark brown; abdomen with a prominent cream transverse ridge on segment 4; segments 1-3 usually have a pair of indistinct whitish dorsolateral spots; posterior end with small round cremaster.

Observations

Around Perth, adult *G. minyas* (Fig. 6) fly from September to early November. In mid October 2006, we captured seven females near Wanneroo, 25 km north of Perth, in an area of woodland where the understorey was overgrown with the introduced annual veldt grass *E. longiflora*. These were placed in clear plastic food containers with some fresh veldt grass on which they laid their eggs. The eggs remained on the dry, shriveled grass throughout the summer. They were occasionally given a light misting of water to simulate periodic summer showers. Larvae did not develop until April 2007, at which time the dark larval heads became visible through the egg shell.

At the onset of the first autumn rains in early May, fresh veldt grass began to grow. Blades of this grass were placed in the egg containers and this



Figs 1-6. Juvenile stages and adult of *Geitoneura minyas* from Wanneroo, WA. (1) egg, lateral and dorsal views; (2) first instar larva, dorsal and lateral views; (3) first instar setae; (4) mature larva, dorsal and lateral views and frons of head; (5) pupa, dorsal and lateral views; (6) adult female, underside.

triggered an immediate hatching of first instar *G. minyas* larvae. Some larvae were reared indoors in plastic vials, where they were available for microscopic examination; others were transferred outdoors to potted *E. longiflora* tussocks for behavioural observations.

Larvae hatched from eggs by cutting out a circular hole or 'crown' in the top of the egg case. This 'crown' frequently fell back into place once the larva departed, leaving the empty egg case appearing intact. The egg cases were not consumed by the larvae. Larvae on potted veldt grasses fed during the day and at night. When not feeding they sheltered on the underside of a grass blade, usually in close proximity to their feeding scars. In windy conditions they sometimes retreated to more secure positions among the lower stems of the grass tussock. Larvae ate most of the leaf before moving to another grass blade.

Pupation occurred in September. Larvae pupated on the food plant, suspended head downwards by the cremaster. Pupal duration was 20 to 22 days, with adults emerging in late September and early October. A pre-emergence pupa is shown in Fig. 7. Larvae reared indoors developed much more rapidly than those outside, with the first adults emerging in August; this is no doubt due to the warmer conditions indoors.

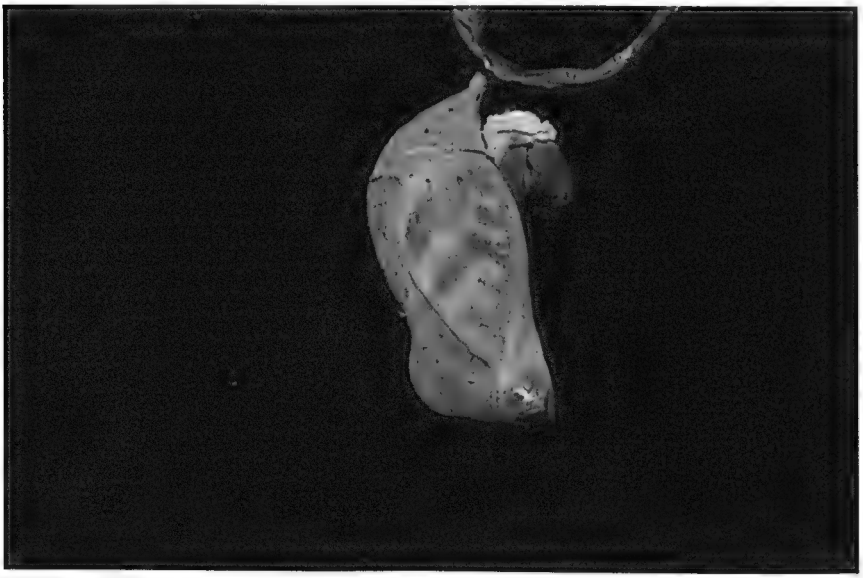


Fig. 7. Photograph of pre-emergence pupa of *Geitoneura minyas* from Wanneroo, Western Australia.

Comparison with *G. klugii*

Structural differences were noted between the eggs of *G. minyas* and those of *G. klugii*. Twenty-one *G. minyas* eggs from Wanneroo had from 12 to 14 vertical ribs, whereas nineteen *G. klugii* eggs collected in 2005 at Garden Island, 15 km SSW of Fremantle, had from 14 to 16 ribs. The colour and patterning on the eggs of both species was very similar. In South Australia, *G. klugii* eggs were reported to have from 14 to 18 vertical ribs (Grund 2002). First instar larvae of both species are similar, although the dorsal and dorsolateral lines in *G. klugii* are generally more distinct.

Pupae of *G. minyas* and *G. klugii* are morphologically similar, although *G. klugii* pupae are usually larger than those of *G. minyas*. A series of *G. minyas* pupae from Wanneroo measured 11-12 mm in length, whereas *G. klugii* pupae from Garden Island were 11-13 mm. The paired abdominal segment spots are usually more distinct in *G. klugii*. At Wanneroo, *G. minyas* pupae were either green or brown but in *G. klugii* only green pupae have been recorded.

The reproductive strategies of both species in Western Australia are similar. Each has a delayed larval hatching, which coincides with the availability of new growth from their respective food plant grasses. Braby (2000) suggested that for *G. klugii* this delayed hatching, synchronized with the availability of new growth on the food plant following the autumn rains, may be a survival mechanism for coping with summer drought, when many grasses are dry and probably unpalatable to larvae (Braby and New 1988a, b).

Adult behaviour of the two species is also very similar. Female *G. minyas* mate once and, like *G. klugii*, reject further attempts from courting males by hovering close to the ground and beating their wings rapidly (Braby 2000). At Wanneroo, *G. minyas* and *G. klugii* readily visit white-flowered daisies in gardens adjacent to native bushland. They also visit the flower-spikes of the native grass-tree *Xanthorrhoea preissii* (Xanthorrhoeaceae). In eastern Australia, adult *G. klugii* seldom feed from flowers but have been observed feeding on sap of *Acacia* and *Eucalyptus* (Braby 2000).

On mainland Western Australia, *G. minyas* and *G. klugii* frequently occur together; however, only *G. klugii* has been recorded on off-shore islands (Williams 1997, Williams and Powell 2000, 2006, Powell and Williams 2007). On both Garden and Rottnest islands *G. klugii* is abundant, as is its larval food plant *Austrostipa flavescens* (Poaceae). In contrast, the introduced veldt grass *Ehrharta longiflora*, on which *G. minyas* is known to feed, is either absent or uncommon on these islands. The native food plant for *G. minyas* is unknown.

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THE ORIENTAL LILY-FLOWER THRIPS *TAENIOTHRIPS EUCHARII* (WHETZEL) (THYSANOPTERA: THRIPIDAE) NEW TO AUSTRALIA

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Abstract

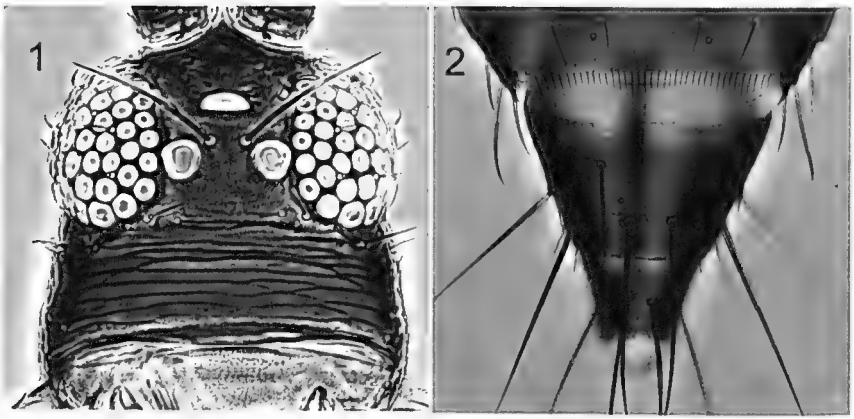
Taeniothrips eucharii (Whetzel) is newly recorded from Australia, near Brisbane in Queensland and on Lord Howe Island off the coast of New South Wales, from the flowers of various Amaryllidaceae.

Introduction

In late December 2007, in a garden on Lord Howe Island, three females of a large, dark but unidentifiable thrips were found in a flower of a *Crinum* lily (Amaryllidaceae). Subsequent study indicated that this was a species of *Taeniothrips*, an essentially Asian genus not known previously from Australia. This discovery triggered a search at Brisbane of suitable garden lily flowers during January 2008, and the same thrips species was found to be well established, with both sexes present in the flowers of *Zephyranthes* and *Hymenocallis* (Amaryllidaceae). The thrips was later identified as *Taeniothrips eucharii* (Whetzel), using reference specimens collected during 2006 in the gardens of the University of Malaya at Kuala Lumpur, Malaysia, from *Hymenocallis* flowers.

Discussion

This thrips was described originally in 1923 from Bermuda on *Eucharis*, but has also been described, under two synonymic names, from Taiwan and from Japan (see Mound 2008). Bhatti (1990) recorded it from Korea, China, Hawaii and the Netherlands, while Diffie *et al.* (2008) listed it from Florida and Georgia, USA. Apart from 26 fossil species, there are 22 species listed (Mound 2008) in the genus *Taeniothrips*, of which three are from Europe, one from western North America and 18 from various Asian countries. *Taeniothrips eucharii* therefore presumably originated in Asia, although there is no modern treatment of the genus from which relationships might be deduced. Within the Australian fauna of Thripidae, *T. eucharii* is recognisable by the rather long head that is constricted behind the eyes (Fig. 1), with long interocellar setae that arise close together but without a pair of setae in front of the first ocellus, and from the very long and regular comb of microtrichia on the eighth abdominal tergite (Fig. 2). The only Thripidae in Australia with which *T. eucharii* might be confused are orchid flower thrips of the genus *Dichromothrips* Priesner; however these have the ocellar setae shorter and positioned differently, the metathoracic endofurca bears a well-developed spinula (absent in *Taeniothrips*) and they do not have the two pairs of long setae on the pronotum that are present in *Taeniothrips* species.



Figs 1-2. *Taeniothrips eucharii*. (1) head; (2) tergites VIII-X.

This thrips has presumably been distributed by the horticultural trade; during the early 1960s it was taken regularly by the quarantine service of the USA (O'Neill 1962). It seems to breed particularly on species of Amaryllidaceae and has been taken in association with the flowers, leaf bases and bulbs of several genera of this family, including *Crinum*, *Eucharis*, *Hymenocallis*, *Lycoris*, *Narcissus* and *Zephyranthes*. Masami Masumoto (pers comm.) has informed us that this thrips is found commonly on *Liriope* (Liliaceae) in Japan and has been taken in quarantine from *Lycoris* imported from Taiwan. Records from other plants seem more likely to refer to dispersing adults rather than plants on which this thrips breeds. There is little evidence of the species being a pest, but discoloration and silver scarring around leaf bases has been associated with this thrips (O'Neill 1962).

Specimens discussed here are deposited in the Australian National Insect Collection, Canberra.

Acknowledgement

We are grateful to Masami Masumoto, Yokohama Plant Protection Station, Japan, for sharing with us his knowledge of this thrips.

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TWO NEW SPECIES OF *POLYRHACHIS* FR. SMITH (HYMENOPTERA: FORMICIDAE: FORMICINAE) FROM AUSTRALIA, BASED ON FORMERLY QUADRINOMINAL TAXA

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Abstract

Two species of the genus *Polyrhachis* Fr. Smith, 1857, originally described as quadrinominal infrasubspecies, are redescribed as new species, *viz*: *P. incerta* sp. n. [='*Polyrhachis (Campomyrma) micans* r. *ops* var. *rufa*' Crawley] and *P. cydista* sp. n. ['*Polyrhachis (Chariomyrma) hookeri* r. *obscura* var. *bellendenensis*' Forel]. Both are illustrated and characters separating them from closely similar taxa are given. Their known distributions and nesting habits are summarised. A note on *P. micans* Mayr ['*Polyrhachis (Campomyrma) micans* st. *ops* var. *dentinasis*' Santschi] is included.

Introduction

In his paper on infrasubspecific names of Australian ants, Taylor (1986) listed 48 species described by earlier authors as quadrinominal entities. Five applied to the genus *Polyrhachis* Fr. Smith. However one of them, '*Polyrhachis rastellata* r. *laevior* v. *pilosa*' Forel, 1902, had already been raised to specific rank by Donisthorpe (1938). Kohout (1989) later described *Polyrhachis foreli* Kohout and referred to it the material of the unavailable name '*Polyrhachis (Myrma) relucens* r. *andromache* v. *andromeda*' Forel, 1915 (and also '*Polyrhachis (Myrma) relucens* ssp. *decipiens* var. *papuana*' Emery, 1897 from New Guinea). The specimens related to the unavailable name '*Polyrhachis (Campomyrma) micans* st. *ops* var. *dentinasis*', described by Santschi (1920), are considered here to be synonymous with *Polyrhachis micans* Mayr, 1876.

The two remaining quadrinominal names still featured on the list of Australian *Polyrhachis* (*viz*. '*Polyrhachis (Campomyrma) micans* r. *ops* var. *rufa*' Crawley, 1921 and '*Polyrhachis (Chariomyrma) hookeri* r. *obscura* var. *bellendenensis*' Forel, 1915) are considered unavailable under article 45.5.1 of the International Code of Zoological Nomenclature (1999), which states that 'A name that has infrasubspecific rank under the provisions of this Article cannot be made available from its original publication by any subsequent action (such as 'elevation in rank') except by a ruling of the Commission'. However, the taxa represented by both quadrinominal names are distinct species and, in order to clean up the last nomenclatural anomalies within the Australian *Polyrhachis*, I hereby describe them as new species.

Both newly described species are relatively rare and until quite recently were known only from the specimens of the original series. However, intensive collecting in recent years, including an increasing number of environmental studies, has produced specimens of many poorly known, previously described species of *Polyrhachis*, as well as a wealth of new species. For example, the

number of undescribed Australian species in the two largest Australian subgenera, *P. (Campomyrma)* Wheeler and *P. (Chariomyrma)* Forel, to which the species described below belong, has risen dramatically and the actual fauna in both subgenera is likely to be three times the number of currently described species.

Methods

Photographs were taken by Dr Yoshiaki Hashimoto (MNHA) with an Olympus SZX12 stereomicroscope and Olympus DP70 digital camera and the digital images processed using Helicon Focus (Mac OSX version) and Photoshop CS2 (Adobe Systems Inc., USA) software. All photographs represent the primary types.

Standard measurements (in mm) and indices follow those of Kohout (2006): TL = Total length (the necessarily composite measurement of the outstretched length of the entire ant measured in profile); HL = Head length (the maximum measurable length of the head in perfect full face view, measured from the anterior-most point of the clypeal border or clypeal teeth, to the posterior-most point of the occipital margin); HW = Head width (width of the head in perfect full face view, measured immediately in front of the eyes); CI = Cephalic index (HW x 100/HL); SL = Scape length (length of the antennal scape, excluding the condyle); SI = Scape index (SL x 100/HW); PW = Pronotal width (width of the pronotal dorsum measured at the bases of the pronotal spines, or across the humeri in species without spines); MTL = Metathoracic tibial length (maximum measurable length of the tibia of the hind leg). Measurements were taken using a Zeiss (Oberkochen) SR stereomicroscope with an eyepiece graticule calibrated against a stage micrometer.

Abbreviations. General: Bch – Beach; Ck – Creek; NP – National Park; rf. – rainforest; w – worker/s; xing – crossing. Collectors: ANA – A.N. Andersen; BBL – B.B. Lowery; CJB – Chris J. Burwell; RJK – R.J. Kohout; SKR – S.K. Robson. Institutions (with names of cooperating curators): ANIC – Australian National Insect Collection, Canberra (Dr S.O. Shattuck); BMNH – The Natural History Museum, London, UK (B. Bolton, Ms K. Goodger, Ms S. Ryder); MCZC – Museum of Comparative Zoology, Harvard University, Cambridge, MA, USA (Dr S.P. Cover); MHNG – Muséum d'Histoire Naturelle, Geneva, Switzerland (Drs C. Besuchet, I. Löbl, B. Mertz); MNHA – Museum of Nature and Human Activities, Sanda, Hyogo, Japan (Dr Yoshiaki Hashimoto); NHMB – Naturhistorisches Museum, Basel, Switzerland (Drs M. Brancucci, D.H. Burckhardt); NMNH – National Museum of Natural History, Smithsonian Institution, Washington, DC, USA (Dr T.R. Schultz); NRMS – Naturhistoriska Riksmuseet, Stockholm, Sweden (Drs K-J. Hedquist, F. Ronquist, B. Viklund); OXUM – Hope Entomological Collections, University Museum, Oxford, UK (Drs C.O'Toole, D. Mann); QMBA – Queensland Museum, Brisbane (Dr C.J. Burwell).

Systematics

Genus *Polyrhachis* Fr. Smith, 1857

Polyrhachis Fr. Smith, 1857: 58. Type species: *Formica bihamata* Drury, 1773, by original designation.

Subgenus *Campomyrma* Wheeler, 1911

Campomyrma Wheeler, 1911: 860 (as subgenus of *Myrma* Billberg, 1820; = *Polyrhachis* Fr. Smith, 1857). Type species: *Polyrhachis clypeata* Mayr, 1862 (junior synonym of *Polyrhachis exercita* Walker, 1859), by original designation.

Polyrhachis incerta sp. n.

(Figs 1, 3-4)

'*Polyrhachis (Campomyrma) micans* r. *ops* var. *rufa*' Crawley, 1921: 97. Original material: workers, QUEENSLAND, Townsville, 11-12.xii.1902 (F.P. Dodd), ANIC, BMNH, MCZC, OXUM, QMBA (examined) (unavailable name).

Types. Holotype worker, NORTHERN TERRITORY: Kakadu NP, Nourlangie Rock, 12°51'S, 132°49'E, 18.xi.1993, open sclerophyll forest, strays on ground and low vegetation, R.J. Kohout acc. 93.50. *Paratypes*: 3 workers, same data as holotype; 1 worker, same data as holotype except A.N. Andersen coll. Holotype (QMT 152088) in QMBA; 2 paratypes in ANIC, 1 paratype each in BMNH and MCZC.

Additional material examined. NORTHERN TERRITORY: Kakadu NP, Ranger Uranium lease site, vii.1993 (ANA) (w); Groote Eylandt, i.1983 (G. Barrett) (w); ditto, G. Webb Pty Ltd site, 16-19.ix.1991 (G. Webb) (w). QUEENSLAND: original specimens of 'var. *rufa*' (w).

Description. Worker. Dimensions (holotype cited first): TL *c.* 7.96, 7.56-8.32; HL 2.00, 1.87-2.03; HW 1.81, 1.68-1.84; CI 90, 87-92; SL 2.09, 2.00-2.15; SI 115, 115-123; PW 1.47, 1.34-1.50; MTL 2.43, 2.28-2.50 (9 measured).

Mandibles with 5 teeth reducing in length towards base. Anterior clypeal margin widely medially truncate; truncate portion with irregularly, obtusely denticulate corners. Clypeus with blunt, poorly defined median carina; almost straight in profile with shallowly impressed basal margin. Frontal carinae sinuate with moderately raised margins; central area concave with poorly indicated frontal furrow. Sides of head in front of eyes weakly convex, only marginally narrowed towards mandibular bases; behind eyes sides forming rather distinct, narrowly rounded, occipital corners. Eyes moderately convex, in full face view breaking lateral cephalic outline. Ocelli lacking. Pronotal dorsum distinctly wider than long; humeri bluntly angular with margins converging anteriorly towards pronotal collar; lateral pronotal margins subparallel, posteriorly rounding into well impressed, anteriorly bowed promesonotal suture. Mesonotal dorsum with lateral margins converging posteriorly in weakly convex line; metanotal groove poorly indicated. Propodeal margins weakly converging posteriorly, or virtually subparallel in some specimens, terminating in short, upturned, somewhat dorsally flattened,

acute teeth; their inner margins continuous for some distance but failing to meet medially; propodeal dorsum curving into steeply oblique declivity in medially uninterrupted line. Petiole scale-like, slender and more-or-less triangular in lateral view; dorsum armed with a pair of slender, medium length, weakly diverging, acute spines; inner margins of spines contiguous medially, forming rather narrow, 'U'shaped dorsum of petiole; outer margins of spines descending into distinct, dentate angles. Anterior face of first gastral segment flat, marginally higher than full height of petiole, narrowly rounding onto dorsum of gaster.

Head, mesosoma and dorsum of gaster densely and finely reticulate-punctate, with sculpturation on vertex, sides of head and dorsum of mesosoma somewhat organised into weak, irregular, longitudinal striae, with those on mesonotal dorsum diverging posteriorly towards lateral margins of segment. Sides of mesosoma and petiole finely wrinkled. Sides and venter of gaster shagreened.

Mandibles with numerous curved, golden hairs. Anterior clypeal margin medially with several, anteriorly directed, unequal length golden setae and shorter setae fringing margin laterally. A single pair of very short, erect hairs near basal clypeal margin and several hairs on posterior face of fore coxae. Gaster with medium length, mostly posteriorly inclined, golden hairs around apex and along posterior margins of sternites. Very short, closely appressed pubescence in various densities over most dorsal body surfaces and gastral venter.

Distinctly light to medium reddish-brown, with only mandibular teeth, anterior clypeal margin, frontal carinae, pronotal and mesopleural margins, propodeal and lateral petiolar teeth very narrowly bordered with black. Vertex, dorsum of mesosoma along promesosonotal suture and sides of mesosoma a shade darker in some specimens.

Sexuals and immature stages unknown.

Remarks. As suggested by the original infrasubspecific name ('*Polyrhachis micans ops rufa*'), *P. incerta* is closely allied to both *P. micans* Mayr, 1876 and *P. ops* Forel, 1907; however, all three species are easily distinguished from each other and from another group of very similar species that includes *P. schwiedlandi* Forel, 1902 and several other, mostly undescribed species. Besides their relatively large size, all these species share a broadly truncate anterior clypeal margin, eyes situated close to the occipital corners of the head and a scale like petiole. In species related to *P. micans*, the petiole is armed with a pair of dorsal, often elongated, acute spines and a pair of usually shorter lateral spines or teeth that may be reduced to blunt angles. In contrast, in species related to *P. schwiedlandi*, the dorsum of petiole is arcuate with a shallow median emargination and a pair of very short lateral spines. However, in several newly discovered species the petiolar dorsum

bears a pair of rather distinct teeth and a pair of short, acute, dorso-posteriorly curved lateral spines, an arrangement not unlike that found in those species related to *P. micans*.

Polyrhachis incerta can be distinguished from *P. micans*, *P. ops* and other closely related species using the following key.

1 Petiolar spines with dorsal pair distinctly longer than lateral pair that are often reduced to mere angles 2

– Petiolar spines more-or-less subequal ..... *P. ops* Forel

2 Lateral petiolar spines slender and acute, curved strongly backwards and outwards; propodeum with a pair of dorso-medially flattened, upturned spines ..... *P. micans* Mayr

– Lateral petiolar spines reduced to short teeth or mere angles; propodeum with a pair of very short teeth or tubercles 3

3 Body and appendages light to medium reddish-brown, rarely body bicoloured with parts of head and much of mesosoma black or dark brown..... *P. incerta* sp. n.

– Body entirely black with appendages often dark reddish-brown 4

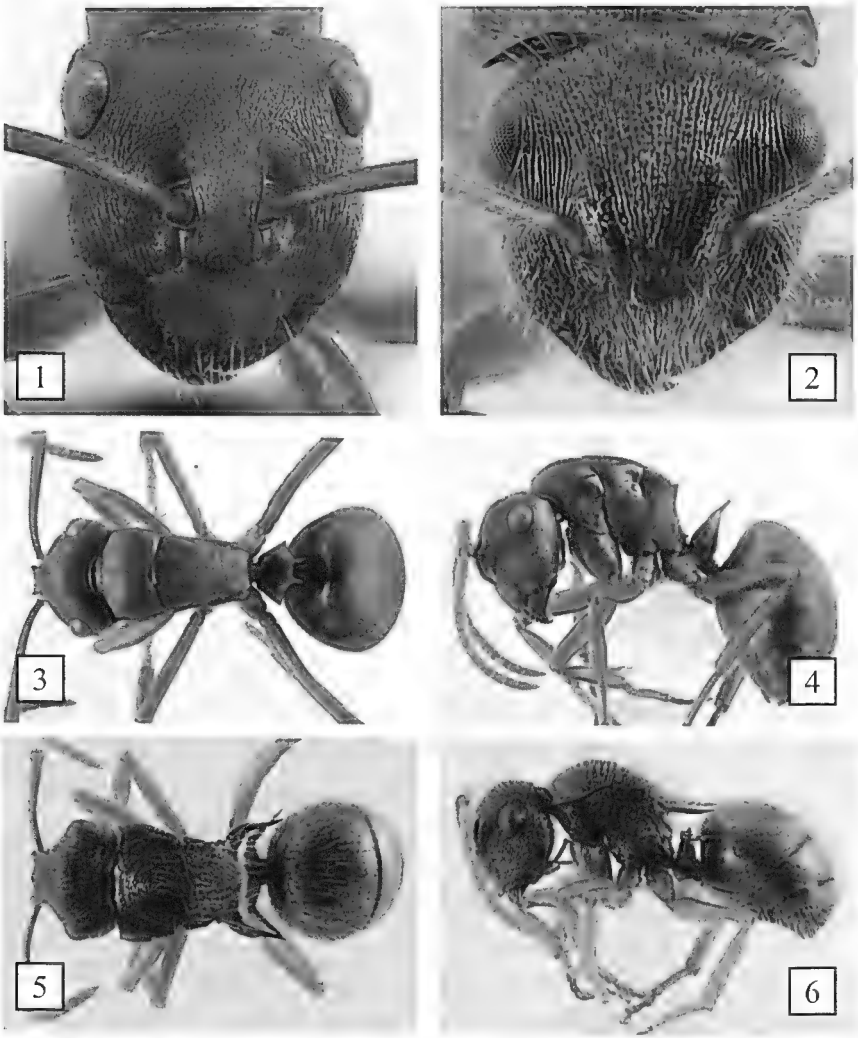
4 Propodeal dorsum very narrow, about 1.5 times longer than wide with parallel lateral margins ..... *P. prometheus* Santschi

– Propodeal dorsum wider than long with strongly posteriorly converging lateral margins ..... *P.* '*Campo* 12' (undescribed)

Polyrhachis incerta appears to be a very rare species that is currently known from two widely separated regions. The specimens of the type series were taken in Kakadu National Park in the Northern Territory, with additional specimens collected on Groote Eylandt. The specimens from Queensland were apparently collected on a single occasion by F.P. Dodd at Townsville (see data above). Specimens from both areas are very similar morphologically, but differ distinctly in colour pattern. Specimens from the Northern Territory are more-or-less uniformly reddish-brown, while those from Queensland are distinctly bicoloured, with the sides of head, vertex and most of the mesosoma, except the propodeal declivity, black or very dark reddish-brown. The nest of *P. incerta* is unknown, but the foraging habits of the species suggest it is ground-nesting like other, closely related species such as *P. micans*, *P.* '*Campo* 12' and *P. prometheus*. *Polyrhachis incerta* was listed as *P.* '*Campo* 01' by Kohout (2000: 190).

Polyrhachis micans Mayr, 1876

Polyrhachis micans Mayr, 1876: 76. Syntype workers, queen. Original localities: AUSTRALIA, QUEENSLAND, Rockhampton, Peak Downs (A. Dietrich), NHMW (examined).



Figs 1-6. *Polyrhachis* spp. (1-2) head in full face view: (1) *P. incerta* sp. n.; (2) *P. cydista* sp. n. (3, 5) dorsal habitus: (3) *P. incerta* sp. n.; (5) *P. cydista* sp. n. (4, 6) lateral habitus: (4) *P. incerta* sp. n.; (6) *P. cydista* sp. n. (All images are of the holotypes and are not to scale).

Polyrhachis (Campomyrma) micans Mayr; Santschi, 1920: 185. Combination in *P. (Campomyrma)*.

'*Polyrhachis (Campomyrma) micans* st. *ops* var. *dentinasis*'. Santschi, 1920: 185. Original locality: QUEENSLAND, Townsville, 11.ii.1902 (F.P. Dodd), NHMB (2 workers and alate queen examined) (unavailable name).

Additional material examined. WESTERN AUSTRALIA: Kimberley region, King Edward R., 15°08'S, 126°08'E, vi.1988 (ANA) (w); ditto, 1.vi.1988 (I.D. Naumann) (w); Kimberley region, Mertens Ck, ix.1993 (S. Morrison) (w). QUEENSLAND: Cape York Pen., 6 km E of Heathlands, 18-22.iv.1992 (G. Cassis) (w); Alehvale Stn, 9 km SE of Croydon, 18°15'S, 142°18'E, 16.x.1976 (RJK acc. 76.59) (w); 50 km NW of Charters Towers, 4.i.1977, dry sclero (BBL) (w); 4 km E of Charters Towers, 13.xii.1976, dry sclero (BBL) (w); Britton Ra., 6 km NNE of Homevale, 21°23'S, 148°33'E, 1-6.iv.1975 (RJK accs 75.155, 156/1) (w); German Ck mine, nr Middlemount, 200 km NW of Rockhampton, 23°00'S, 148°30'E, 1997 (ANA) (w); 6 km N of Mt Archer, nr Rockhampton, 23°17'S, 150°34'E, 4.i.1979 (RJK acc. 79.16) (w); Rundle Ra., 36 km NW of Gladstone, 23°39'S, 150°58'E, 24-30.iii.1975 (RJK acc. 75.136/2) (w).

Dimensions of syntypes (queen cited last): TL *c.* 9.42-9.93, 10.03; HL 2.31-2.43, 2.37; HW 2.09-2.18, 2.00; CI 90, 84; SL 2.37-2.46, 2.25; SI 113, 112; PW 1.93-2.06, 2.28; PPW (w only) 1.15-1.22; MTL 2.90-2.96, 2.87 (2 workers, 1 queen measured).

Remarks. I have examined two workers and a queen of the original series of '*Polyrhachis (Campomyrma) micans ops dentinasis*'. In addition to the original identification tags in Santschi's handwriting, the specimens also bear more recent tags added by R.W. Taylor that identify them as *P. micans* Mayr. I have compared these specimens with the earlier selected vouchers (topotypes) of *P. micans* and found them inseparable. Consequently, the earlier opinion of Taylor (unpublished), who considered both names conspecific, is here confirmed.

Subgenus *Chariomyrma* Forel, 1915

Chariomyrma Forel, 1915:107 (as subgenus of *Polyrhachis* Fr. Smith, 1857). Type species: *Polyrhachis guerini* Roger, 1863, by original designation.

Polyrhachis cydista sp. n.

(Figs 2, 5-6)

'*Polyrhachis (Chariomyrma) hookeri* r. *obscura* var. *bellendenensis*' Forel, 1915: 109. Original material: unique worker, QUEENSLAND, Bellenden Ker (E. Mjöberg), NRMS (examined) (unavailable name).

Types. Holotype worker, QUEENSLAND: Mt Hedley, 1-2 km N of Home Rule, 15°45'S, 145°17'E, 200-300 m, 11.vi.1996, rf., R.J. Kohout acc. 96.44. *Paratypes*: 7 workers, queen, same data as holotype. Holotype (QMT 152089), paratype worker and paratype queen in QMBA; 2 paratype workers each in ANIC, BMNH and MCZC.

Additional material examined. QUEENSLAND: Home Rule, 15°45'S, 145°17'E, *c.* 200 m, 9-11.vi.1996, rf. edge (RJK & CJB acc. 96.45) (w); Pilgrim Sands, *c.* 1 km

NW of Cape Tribulation, 16°04'S, 145°28'E, <10 m, 12-15.vi.1996 (RJK acc.96.47) (w); McLean Ck, *c.*19 km SbyW of Cape Tribulation, 16°15'S, 145°26'E, 15.vi.1996 (RJK acc. 96.54) (w); Kuranda, 1.xi.1914 (W.M. Wheeler) (w); ditto, 29.x.1950, rf. (W.L. Brown) (w); Mission Bch., 17°45'S, 146°00'E, 1966 (SKR #799) (w); Rocky Ck xing, 6 km W of Tully, 17°55'S, 145°53'E, 22.ix.1980 (BBL) (w); Broadwater Park, via Ingham, 18°22'S, 145°57'E, 400 m, 3.i.1987 (S. Hamlet) (w); original specimen of 'var. *bellendenensis*' (w).

Description. Worker. Dimensions (holotype cited first) TL *c.* 5.24, 4.28-5.59; HL 1.40, 1.15-1.47; HW 1.31, 1.06-1.37; CI 93, 90-97; SL 1.37, 1.15-1.43; SI 104, 100-109; PW 1.40, 1.18-1.50; MTL 1.40, 1.15-1.50 (27 measured).

Anterior clypeal margin with shallow, medially notched flange, flanked by blunt denticles. Clypeus with blunt median carina, sinuate in profile; basal margin moderately impressed. Frontal carinae sinuate, with raised, laminate margins, separated by rather wide central area; frontal furrow replaced by anteriorly raised, longitudinal carina. Sides of head in front of eyes strongly converging towards mandibular bases; behind eyes immediately rounding into convex occipital margin. Eyes weakly convex, only marginally exceeding lateral cephalic outline in full face view. Ocelli lacking. Mesosoma laterally marginate along its entire length, convex in profile. Pronotal humeri angulate, dorsally concave, with anterior and lateral margins transluscent, narrowly raised and widely laminate. Promesonotal suture distinct; mesonotum with lateral margins converging posteriorly; metanotal groove distinct laterally, rather indistinct medially. Propodeum armed with strong, horizontal, laterally and posteriorly curved, acute spines; spines relatively wide and dorsally flattened in basal halves and distinctly narrowed and slender towards tips. Petiole very slender in side view with anterior and posterior faces converging towards rather acute, transversely convex and posteriorly bowed dorsum, armed with a pair of dorsolaterally diverging spines. Anterior face of first gastral segment distinctly higher than full height of petiole, widely rounding onto dorsum of gaster.

Mandibles finely, longitudinally striate. Clypeus irregularly, longitudinally reticulate-striate. Head mostly longitudinally striate, with sides reticulate-rugose. Pronotal dorsum with somewhat wide, inversely 'U'-shaped striae medially and oblique striae across humeral angles. Mesonotal and propodeal dorsa more-or-less longitudinally striate-punctate, with sides and propodeal declivity mostly horizontally wrinkled. Apical halves of propodeal and petiolar spines, anterior and posterior faces and dorsum of petiole, smooth and highly polished. Gaster finely reticulate-punctate.

Mandibles with numerous, relatively long, curved, golden hairs. Anterior clypeal margin with a few longer setae medially and several short setae laterally. Head, mesosoma, petiole and gaster with numerous long hairs, some almost twice as long as greatest diameter of eyes; hairs on head and mesosoma erect or variously curved, those on dorsum of gaster more

posteriorly curved. Antennae and legs with numerous, short to medium length, erect, golden hairs. Very short, mostly suberect, grey and silvery hairs, rather dense on clypeus and propodeal declivity. Closely appressed, mostly silvery pubescence on dorsum of head, mesosoma and petiole, with distinct reddish tint on mesonotal and propodeal dorsa. Gastral dorsum with relatively long, appressed, rich brassy-golden to somewhat coppery pubescence; rather diluted and more silvery pubescence on sides and venter of gaster.

Head, mesosoma and petiole black; antennae, pronotal humeri and legs, including middle and hind coxae, very light orange; fore coxae and subpetiolar process medium reddish-brown, mandibles a shade darker; dorsum of gaster black, sides and venter very dark reddish-brown.

Queen. Dimensions: TL *c.* 6.10; HL 1.47; HW 1.31; CI 89; SL 1.37; SI 104; PW 1.56; MTL 1.49 (1 measured).

Very similar to worker and apart from differences due to full sexuality, including three ocelli, complete thoracic structure and wings, differing as follows: eyes larger; pronotal humeri bluntly angulate with only anterior margins narrowly laminate; mesoscutum wider than long, with widely rounded anterior margin in dorsal view; median line very short; parapsides flat, only very weakly raised posteriorly; mesoscutum in profile with rather low anterior face and flat dorsum; mesoscutellum flat, not elevated above dorsal plane of mesoscutum; propodeum and petiole with spines similar to those in worker, but shorter; dorsum of mesosoma with rather irregular, reticulate-punctate sculpturation; pilosity and colour virtually identical to worker.

Male and immature stages unknown.

Remarks. As suggested by the original infrasubspecific name ('*Polyrhachis hookeri obscura bellendenensis*'), *P. cydista* is very similar to a complex of species including *P. hookeri* Lowne, 1865, *P. lownei* Forel, 1895 and *P. obscura* Forel, 1895. However, all four species can be easily distinguished with the following key.

1 Head and mesosoma distinctly metallic green, blue or purple or a combination of these colours ..... *P. hookeri* Lowne

– Head and mesosoma uniformly very dark brown or black 2

2 Dorsum of gaster with a distinct longitudinal patch of very dark maroon or purple-coloured, closely appressed pubescence; body with rather irregular, reticulate-rugose sculpturation 3

– Dorsum of gaster without such a patch, with golden or coppery pubescence uniformly distributed over gastral dorsum; body sculpturation generally longitudinally striate-punctate with striae on

pronotal dorsum 'U'-shaped medially and oblique across humeral angles ..... *P. cydista* sp. n.

3 Propodeal spines relatively short, divergent, weakly elevated from their somewhat broadened bases and dorso-ventrally flattened; gaster reddish-brown, distinctly lighter than dorsum of mesosoma ..... *P. obscura* Forel

– Propodeal spines longer, with their length almost equal to distance between their bases, gently curved, with their tips projecting posteriorly; gaster very dark with distinct green metallescence ..... *P. lownei* Forel

Polyrhachis cydista is a rainforest-dwelling and apparently ground-nesting species, endemic to Queensland's Wet Tropics. It was listed as *P.* '*Chario* 04' by Kohout (2000: 193).

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Compiled by Max Moulds (msmoulds@bigpond.net.au) & Editor

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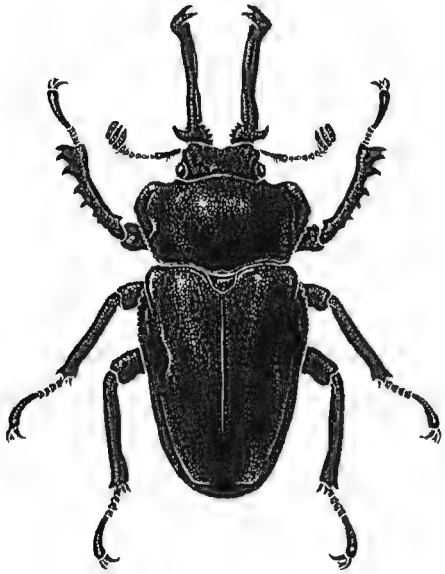

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